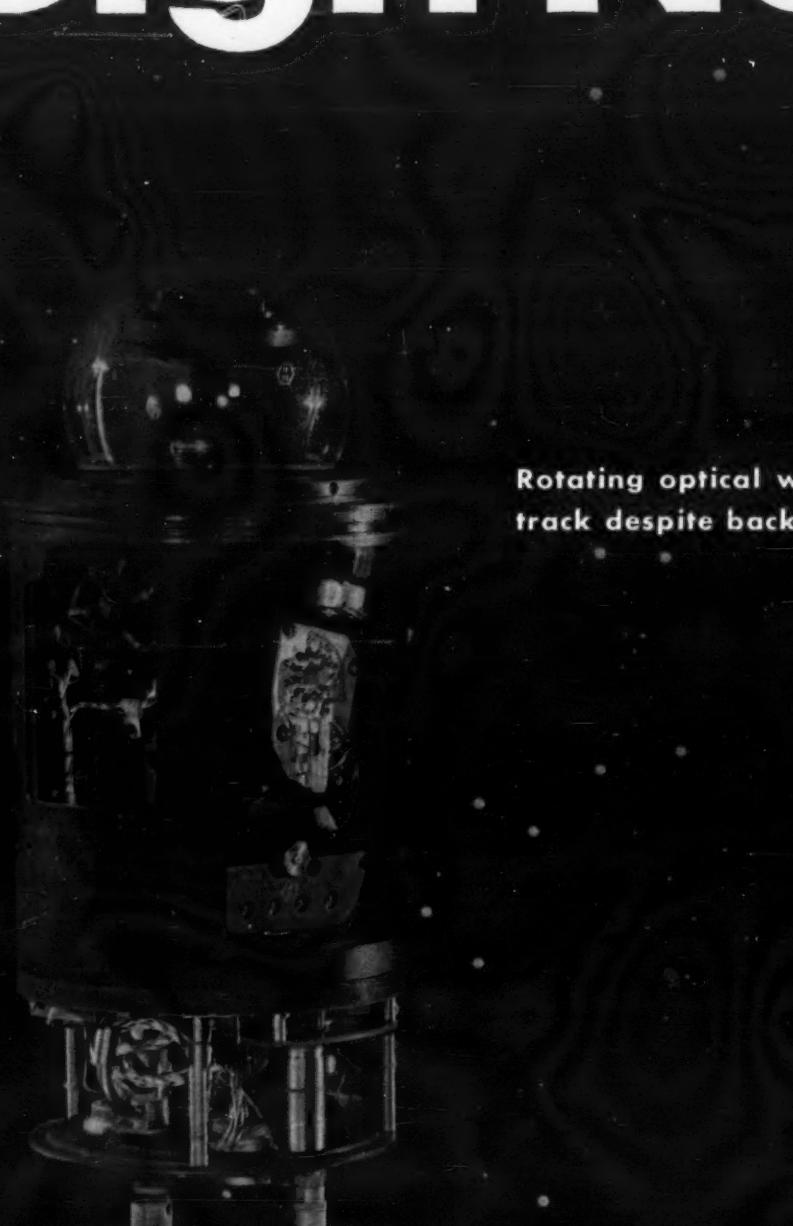


# Design News



Rotating optical wedge permits sextant to track despite background 'noise.' Page 118

## NEW DEPARTURE CASE HISTORY

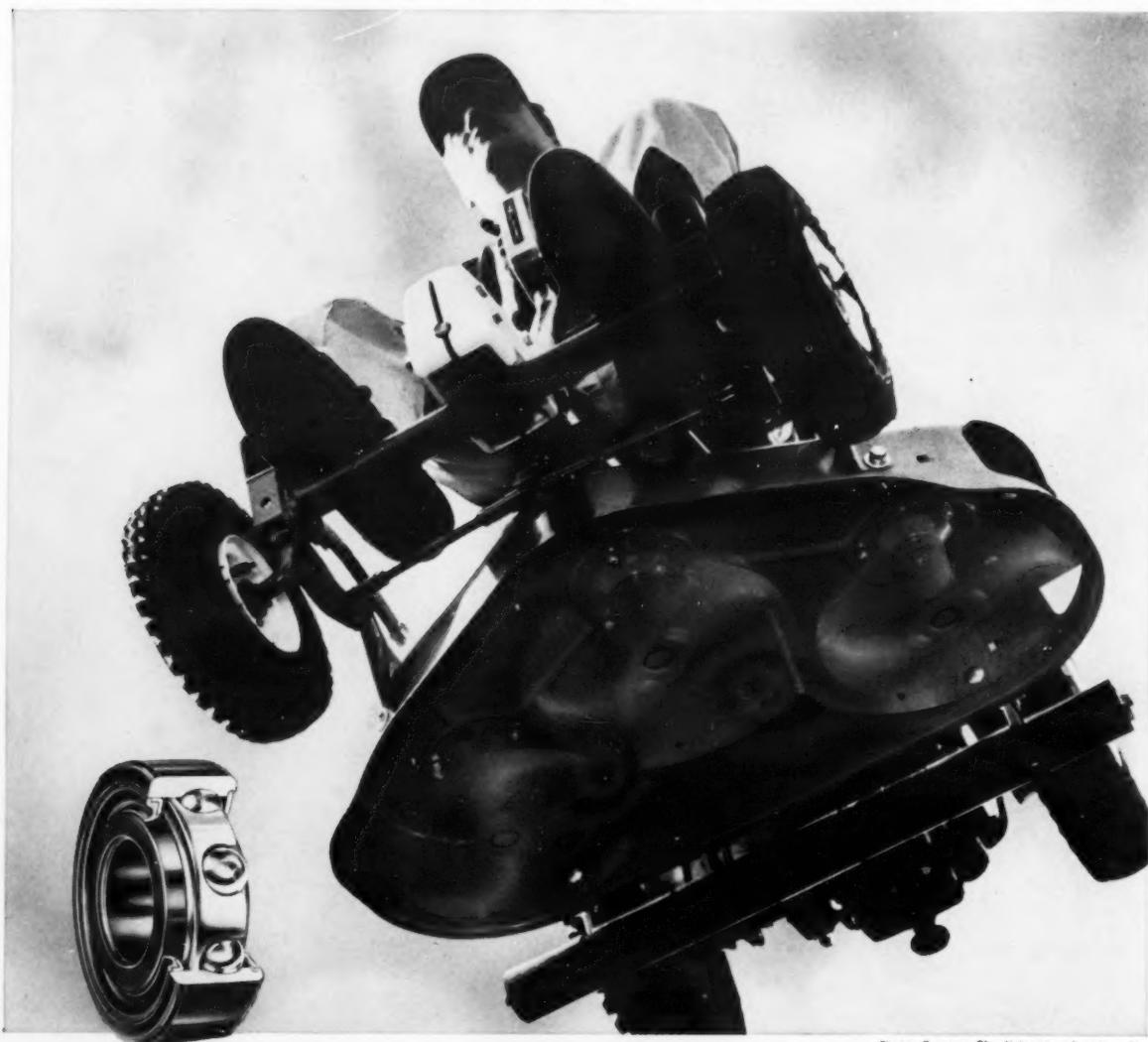


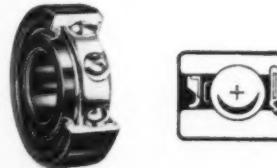
Photo: Courtesy Simplicity Manufacturing Co.

### HOW N/D BALL BEARINGS REDUCE MOWER MAINTENANCE AND PRODUCTION COSTS!

**PROBLEM:** Manufacturer of well-known power lawn mower wanted to make unit more maintenance-free.

**SOLUTION:** Complete re-evaluation of all rotating parts including a study of rotary blade bearings by N/D Sales Engineer. His recommendation: Replace six existing non-integrally sealed bearings with lubricated-for-life New Departure ball bearings. These factory greased bearings are equipped with integral Sentri-Seals\* and Land-Riding Seals. Results: Greater consumer sales appeal by doing away with the need for relubrication maintenance. In addition, N/D's compact ball bearings reduce production cost by eliminating separate bearing seals and six unnecessary grease fittings.

If you're designing new products involving bearings, invite a N/D Sales Engineer to your next design discussion. His knowledge of bearing engineering may result in a savings and valuable new product sales features. Contact him at your local N/D Sales Engineering Office, or call or write New Departure, Division of General Motors Corporation, Bristol, Connecticut. \*New Departure Registered Trade Name.



Integrally sealed N/D ball bearings eliminate need for relubrication, grease fittings and separate seals. These heavy-duty N/D bearings with Sentri-Seals\* and Land-Riding Seals, shut out moist or dry contaminants.

January 16, 1961  
Vol. 16 No. 2  
Worldwide Coverage of Technical

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# DESIGN NEWS

News and Engineering Ideas. More than 48,000 copies every other Monday.

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## DRAFTING TRENDS



### Helpful new booklet suggests drafting, engineering shortcuts

Just published—"DRAFTING SHORTCUTS" is a completely new booklet of helpful ideas and aids for engineers, draftsmen and students. It is well illustrated, clearly and logically written. It contains a wealth of time-saving tips to speed both routine and specialized tasks.

The ideas selected were submitted by professionals and judged by an impartial panel of widely recognized authorities on the various topics covered.

As an example, the section covering *Calculating Ideas* includes a simple means of locating stress points on cantilevered beams, also a simple method for retaining fundamental trigonometric relations.

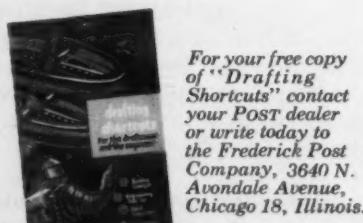
In the section on *Drafting Shortcuts*, our editors have come up with topics like a simplified, fast and easy method for drawing gear teeth profiles and a rapid means of showing twisted wire elements.

**SENSITIZED PAPERS & CLOTHS • TRACING & DRAWING MEDIUMS • DRAWING INSTRUMENTS & SLIDE RULES  
ENGINEERING EQUIPMENT & DRAFTING SUPPLIES • FIELD EQUIPMENT & DRAFTING FURNITURE**

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The *Engineering Data* section covers new, easy-to-use shortcuts to formulas and engineering data.

There's a special section devoted to time-saving techniques on the drawing board, too. One of the suggestions on how to make life easier for the draftsman tells how to use a bent paper clip as a variable guide for making section lines.



## SOUNDING BOARD

### FOR OUR READERS



#### A Helpful Idea

I have been reading and using your magazine for several years in connection with my position as a value analyst. Usually it takes me about one week to complete my examination and, therefore, I must often put the magazine aside to perform other duties.

I think it would be most helpful if you would extend the reader-service page so that the vertical perforations are beyond the edges of the magazine pages. It would then be possible to fold it in over the page at which I am interrupted and give me a built-in book mark.

W. M. NOWAK

Value Analyst

Curtiss-Wright Corp.

Wright Aeronautical Div.

• Thanks to Reader Nowak and many other readers suggesting this change. See Reader-Service Card in this issue.

effects of such ornaments. I wonder what purpose such statistics would serve. Who is to decide how many deaths must be attributable to the ornaments before they may be termed lethal? Isn't it obvious that they are? Saving lives is not a matter of numbers. If it were, who would say that 4000 lives lost on our highways each year are too many? Safety is going to be improved at any significant rate only if everybody involved takes the attitude: let's make any and all improvements that may possibly save a single life. . . .

Too much remains to be done to allow us to dwell on what has been done.

W. E. MEYER

Professor of Mechanical Engineering  
Pennsylvania State University

#### Typographical Error

In your "Materials Applications" article in the Nov. 7, 1960, issue of DESIGN NEWS, (pages 110-111) you stated that the dental drill operating at speeds up to 300,000 rpm developed up to 0.75 in-oz cutting torque and 0.140 in-oz stall torque, and that the air requirement at 60 psi was 1.4 cfm.

According to our calculations, if the output torque is 0.75 in-oz or 0.223 hp over 0.1135 maximum theoretical horsepower, the resulting efficiency is 196 percent.

If, on the other hand, your calculations were based on an air consumption of 1.4 cfm measured in its compressed state of 60 psi instead of at atmospheric pressure, the efficiency would be 61 percent. Are you able to obtain efficiencies in this high range in small air rotors of the design indicated? We would be interested in receiving any information. We have in the past assumed that 10 to 25 percent efficiency would be excellent for turbines of this design, and we would be interested in receiving anything that would point out the error in our calculations if you are not obtaining these high efficiencies.

CLAYTON L. SOLUM  
Director of Research

Aircraft Tools, Inc.

• The figure 0.75 in-oz cutting torque is a typographical error. This figure should be 0.0750 in-oz. This decimal error would, of course, increase the developed horsepower figure by a factor of 10. Substituting the correct figure of cutting torque developed into your calculations would, therefore, reduce this efficiency to 19.6 percent, which is within the range of the 10 to 25 percent typical efficiencies cited.

#### Not a Matter of Numbers

I'd like to comment on Mr. Benedict's letter which you published in your Nov. 21, 1960, issue and in which he chides you for your condemnation of hood ornaments on automobiles. He would like to have statistics on the lethal

## DESIGN VIEWS

### Conspiracy of Silence

In the Nov. 7 issue we made a sincere appeal to the automotive industry to improve design safety. Vic Wigotsky's column, "Seat Belts, Standard—Use Optional", discussed the "packaging the occupant" concept first mentioned in his earlier column, "Horsepower Standard—Safety Optional", (Aug. 29 issue). "Design Views" gave some rather damning statistics on the safety record of the automotive industry and offered some opinions that were somewhat less than favorable on the effort being made by executive management in the automotive industry to improve design safety in automobiles.

The last two paragraphs of "Design Views" were, "I do not question the ability of automotive designers. They can improve design safety. I question the moral honesty of the executive management responsible for policy direction, which year after year ignores design safety.

"Space will be made available to any senior automotive executive responsible for policy decisions on safety who feels he can explain or justify the automotive industries' record of safety—or the design, from the standpoint of safety, of his own company's new models."

I feel it is significant that this offer has not as yet been accepted. Significant in that there really is no defense against the deadly statistics of auto fatalities, nor can they be justified. I am relatively certain that this plea did not go unobserved; I sent copies to the office of the presidents of the major automobile manufacturers. In addition the AMA (Automobile Manufacturers Association) called our Detroit office for an additional copy. It seems to me there are only two alternative conclusions that can be made: either responsibility for design safety has not been clearly assigned or a course of action has been chosen that might be termed a "conspiracy of silence"—merely ignore anything said about design safety, unless it sells cars.

There was, however, heavy response from readers (to date 100 percent in support of our position). Many of these letters are from persons affiliated with and active in some facet of the automotive industry, for instance a letter from Oscar Banker ("Sounding Board", Dec. 19). Mr. Banker was the pioneer in the automatic transmission field and no longer bothers to keep a count of the basic patents he holds (most are related to the automotive field).

We plan to continue investigating design safety in the automotive and aerospace as well as other fields. To be fair we will continue to offer space for replies from persons responsible for policy decisions on safety.

For another facet of safety in design see Ed Schrader's "Seen and Heard" on page 6.

*Ernest R. Cunningham*

Editor

## OVER 5 TIMES THE LIFE OF GRAPHITED BRONZE BEARINGS



**Chemloy 719\***

**CONVENTIONAL  
GRAPHITED BRONZE  
BEARINGS**

**This report** comes from the insulating board division of a large paper company where Chemloy Dry Bearings are outlasting, outperforming and saving money over conventional graphited bronze bearings. They are used to support rollers turning continuously in kiln dryers where lubrication is not practical or possible. Operating temperature is 350°F., bearing loads approximately 25 psi. Figures based on a 3-year service record indicate a yearly savings of \$6,000.00.

### Here are the facts:

1. Chemloy Bearings will last more than 8 years, as against an 18 month life expectancy for graphited bronze.

2. Chemloy's lower coefficient of friction eliminates retainer strips and weldments required for each bronze bearing installation.

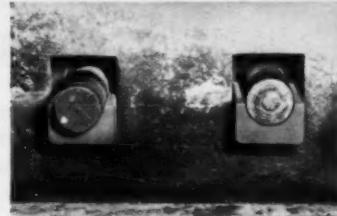
3. Reduction of stub shaft wear due to bearing failure.

Plus increased safety to personnel and equipment through elimination of hazardous welding of retainer strips in a dust-laden atmosphere.

Put Chemloy 719 to work for you. Send b/p or specs. for engineering recommendations. Request Bulletin T-120 and price sheet on sheet, rod and tubing.

Crane Packing Company, 6423 Oakton Street, Morton Grove, Ill. (Chicago Suburb). In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

\*Best in DuPont Teflon Based Bearing Materials



Chemloy Bearings in action. Weld marks at left show positions of retainers formerly needed to keep bronze bearings in position. 20,000 such weldments are eliminated in this instance.

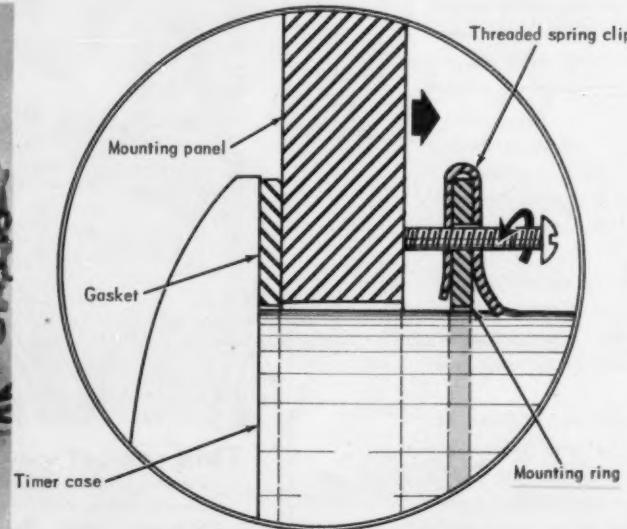
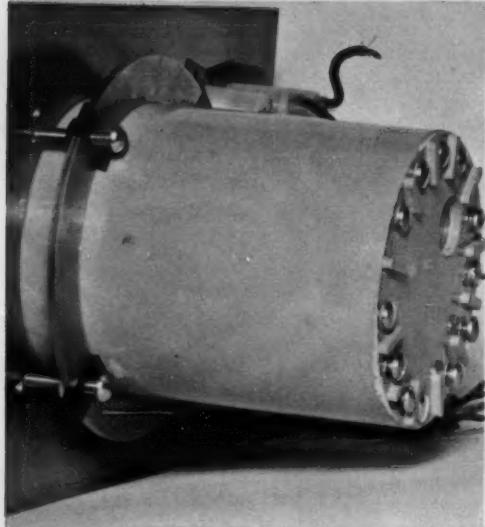
\*Chemloy is an exclusive engineered product of Crane Packing Co. It is the result of extensive research and development to produce a better bearing material.



Circle 4 on Reader-Service Card for more information

## Mounting Ring, Spring Clips Provide One-Hole Timer Installation

Lars G. Soderholm, Midwest Editor



MOLINE, ILL.—Four spring-steel clips and a mounting ring permit installation of a timer on a panel board without drilling mounting holes. The clips bite into the timer case while screws are used to pull the timer in against the panel.

The mounting ring, similar to a large washer, slips over the rear of the timer case after the case has been inserted into the instrument panel. The U-shaped clips are equally spaced along the ring and screws are threaded through the clips. Sharp edges of the clips bite into the case to hold the mounting ring from slipping back on the timer case. The screws are tightened against the instrument panel where they pull the timer face against the panel. The instrument can be removed and reinstalled any number of times without damage.

The "One-Hole" mounting ring is provided by the Eagle Signal Co.

## Circulation of Working Fluid Cools Pump Drive Motor

Robert L. Candlish, Detroit Editor

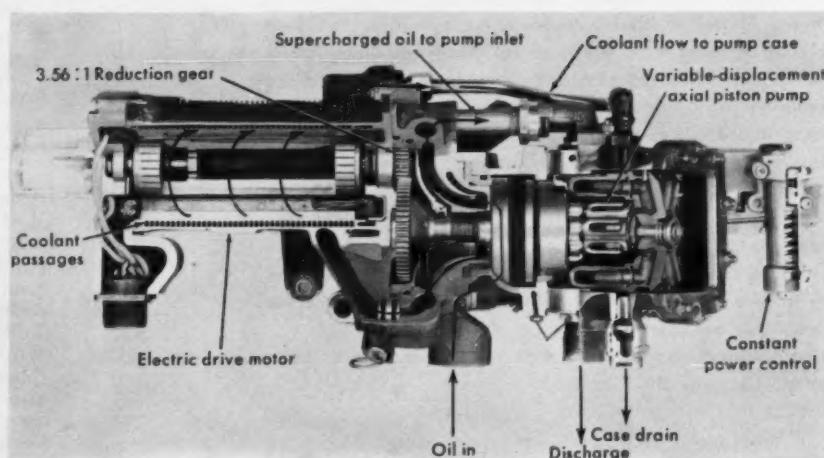
DETROIT, MICH.—The drive motor in this two-stage, aircraft hydraulic pump is cooled by a portion of the working fluid which is diverted from the first stage and circulated around the motor.

The motor is a totally enclosed, 3-phase, 400-cycle induction-type, rated at 12 hp. Full load speed is 11,400 rpm. High length to diameter ratio provides high power to weight ratio in small envelope. Flow guide vanes and cooling fins on the stator provide for heat dissipation and eliminate hot spots.

The pump is driven at 3200 rpm through a 3.56:1 gear box. The centrifugal first stage supercharges the axial piston-type second stage in addition to circulating oil through the double-walled motor casing. Second-stage super-charging permits the pump to operate up to an altitude of 30,000 ft from an unpressurized reservoir.

A constant-horsepower control device is fitted to the pump. The output flow is reduced proportionately following a constant hp curve from 2200 psi to 2950 psi. Above this pressure the output flow is reduced linearly to zero at 3180 psi.

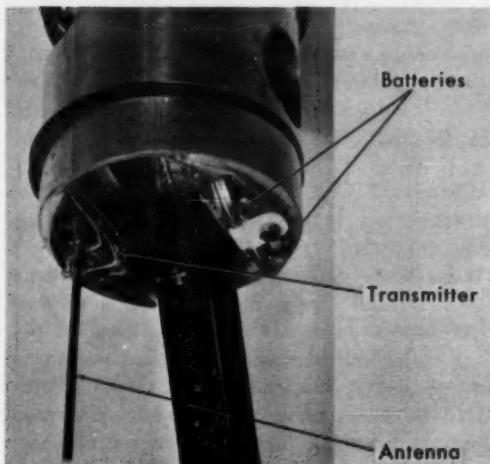
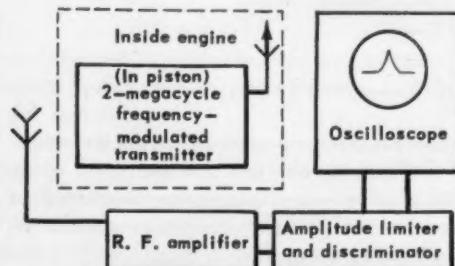
The continuous-duty, oil-cooled motor pump was designed by the Aero Hydraulics Division of Vickers, Inc.



LIQUID-COOLING MOTOR permits optimum performance for given weight and size. Diverting valve after first centrifugal stage regulates flow of oil to motor pump casing. Maximum coolant flow at full output of second stage is two gpm which can absorb 140 Btu per minute from motor. Cooling oil is dumped into pump case port, then to heat sink.

## Telemetering System Simplifies Engine Research

Ronald W. E. Martin, British Editor

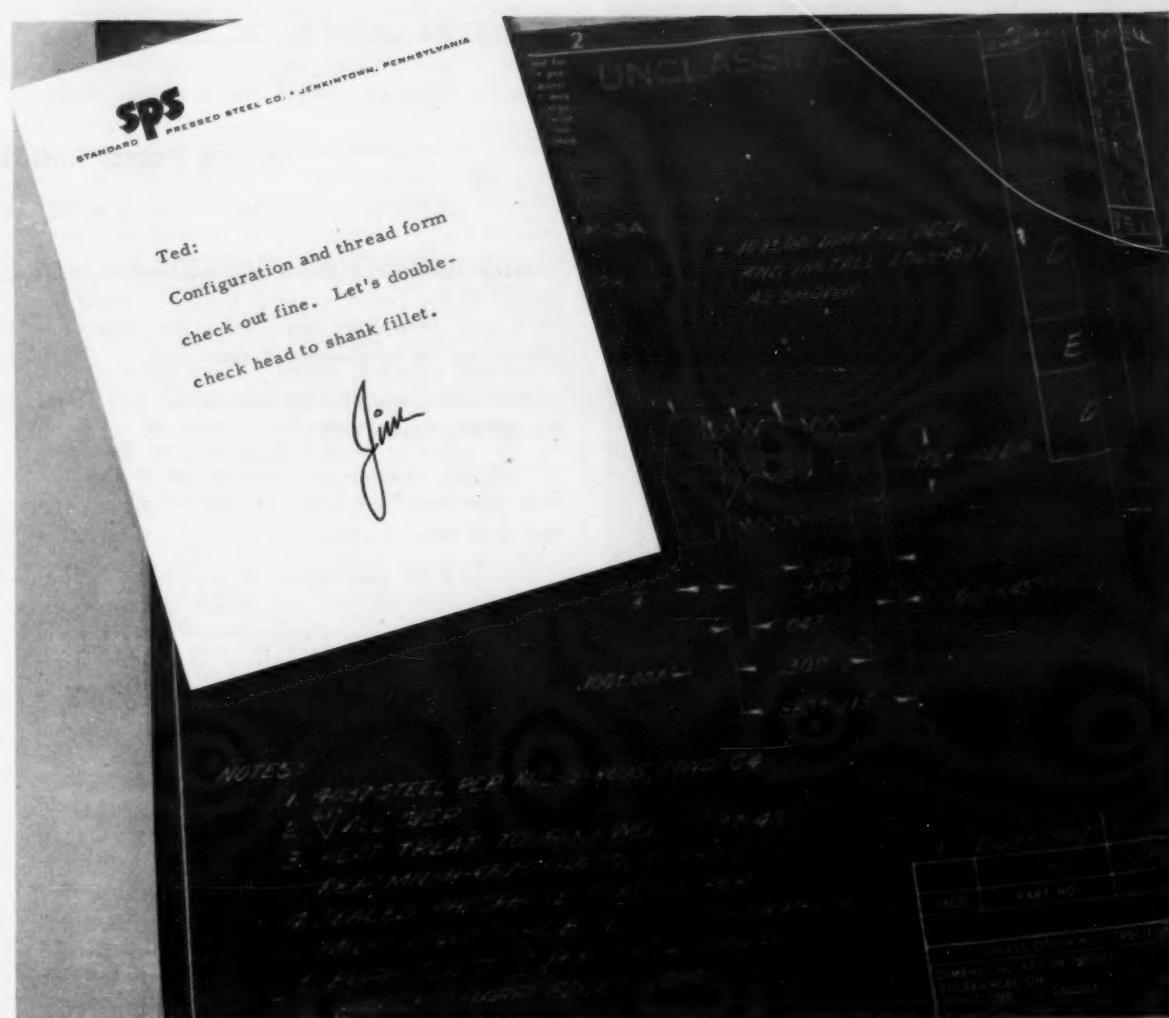


CUTAWAY VIEW of piston shows mounting of batteries, transmitter and antenna.

**SLOUGH, ENGLAND**—Conventional methods of obtaining information from moving parts on different variations of physical quantities (for example: strain, temperature, relative displacement) require the use of devices such as slip rings, flexible leads or intermittent contacts. To overcome the disadvantages of these devices, the British Internal Combustion Engine Research Association has developed a transistorized telemetering system, using small but robust encapsulated units.

In one application a transmitter, complete with antenna, is mounted inside a piston reciprocating in a cylinder. The transmitter telemeters the temperature at a selected point on the piston. A carrier frequency of 2 mc/s is used and is frequency-modulated by the transducer. At the receiver, frequency variations are converted into voltages suitable for display on an oscilloscope.

Similar equipment is used with conventional transducers for telemetering pressures, strains, displacements and accelerations.



### On special fasteners, SPS gives you more than just a quotation

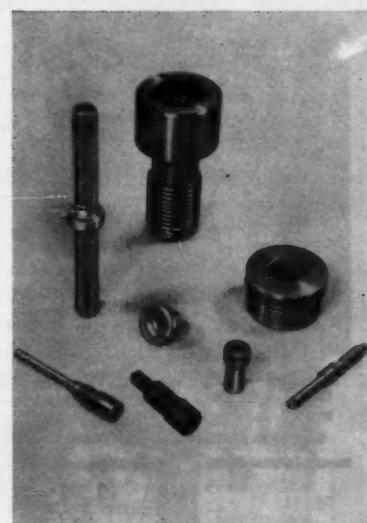
When SPS quotes on your special threaded fastener, you get more than just an accurate estimate of cost. You also get design confirmation. Our engineering and methods people not only interpret your prints and specs; they also analyze them—carefully. And if they have any questions (socket depth, fillet radius, etc.), they double-check with you.

Certainly nobody knows all the answers on threaded fasteners. But we can say this: No one in the industry has invested more in fastener research and development than SPS . . . with commensurate results. Because of this experience, we believe we can offer a constructive or economical design suggestion where specialists are concerned.

Production facilities? SPS can meet any requirement you may have in a socket-type fastener. Special con-

figuration, special material, special threads, special plating or surface treatment, special tolerances . . . we are equipped to handle them all, utilizing the most advanced manufacturing and quality-control techniques.

Whatever your needs in threaded fasteners, it will pay you to check with SPS. Whether you want design confirmation or complete engineering consultation service from the outset, we make it our business to see that you get a sound, reliable part. Contact your local SPS distributor or write Standard Pressed Steel Co., SPECIAL INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 6, PA.



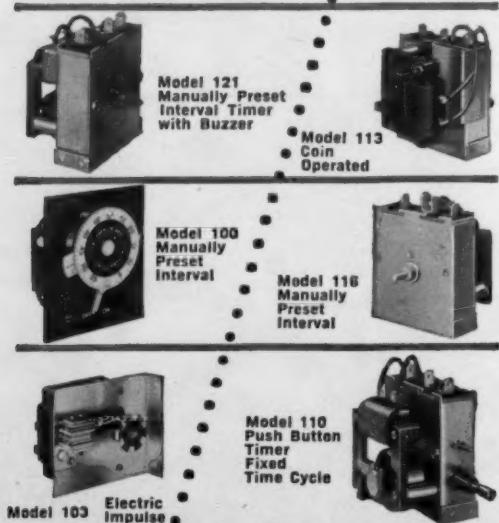
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where reliability replaces probability

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## SEEN AND HEARD

### Spare Parts, Reliability—or Low Bid

Edward W. Schrader, Western Editor

"Material failures or malfunctions were involved in 43 percent of the [naval aircraft] accidents during the fiscal year 1960. This represents a 25 percent increase over the involvement 5 years ago."

"We sole-source all ICBM spares; we can't afford the risk of program delay."

"Reliability of spare parts from sources of replenishment other than the original supplier is a difficult and elusive subject."

These are the observations of responsible Department of Defense officials and military officers on the subjects of reliability and replenishment spare parts in operational aircraft. The problem of reliable spare parts in operational weapons systems will increase.

#### PROPRIETARY DATA

The difficulty starts with two basic government documents—the Armed Services Procurement Regulation IX (2) and Specification MIL-D-70327. Both of these documents are now being revised. At the Multer Committee hearings, small business and its spokesman, the Strategic Industries Association, expressed their views. The military specification is being revised as a result of pressure by some government maintenance people.

ASPR IX (2) has been interpreted to require data from a manufacturer for unlimited use by government procurement officials. This means detail drawings of components must be given to the government for buying spares. The Military Procuring Officer then arranges to procure by either sole source, negotiated-bid or advertised bid.

The drawings used are prepared in accordance with the specification MIL-D-70327. In practice, it requires that all design data, proprietary data and know-how be transferred, by means of drawings and specifications, to the government.

It is possible to eliminate certain data on the set of drawings supplied to the government. Much of industry, therefore, maintains two sets of drawings, one for fabricating the part in its own plants and one for submission to the government under the data clause in the contract.

The regulation and the specification are being revised to eliminate this loophole so that all data for reproducing the parts must appear on the drawings.

#### CONFLICT

Fundamentally, here is a conflict between the proponents of two popular concepts. On one hand is the ownership of proprietary information developed at private expense; on the other hand is competition by advertised bidding.

Application of the low bidder concept can cost the American taxpayer many times the alleged saving. The loss could be the price of an airplane and its crew, due to the unreliability of a single part.

#### AIRCRAFT RELIABILITY

The Commander, U. S. Naval Aviation Safety Center, says,

"Accident records reveal that 1/3 of all A3D aircraft have been involved in major accidents having material unreliability as a factor. As a result of these accidents, we have lost 21 of these aircraft, costing approximately \$60 million.

"Can we expect, then, that 1/3 of all A3J aircraft will be involved in major accidents having material reliability as a factor? We predict that without maximum attention to reliability in all its facets, our A3J losses will be at least this severe. The added complexity and increased performance of new aircraft allow no other conclusion."

If this is the starting point of unreliability, what can be expected if unqualified components are purchased as replenishment spare parts?

#### REPLENISHMENT SPARES

Rear Admiral J. E. Dodson, Assistant Chief for Fleet Readiness, advises, "Whenever replenishment spares are procured on advertised bid, all qualified bidders are furnished complete documentation (i.e., specifications, drawings, etc.) on which to base their bids. This documentation is derived from and is based on the original vendor's product. The replenishment spare contractor is required to comply with this documentation and his product is subjected to the same government qualification and inspection as the original vendor."

Admiral Dodson makes a basic assumption in his statement. He assumes that all specifications and drawings are complete; that "know-how" and experience can be expressed in drawings and specifications; that the vendor supplying the replenishment spare part has the engineering and design capability to solve any



problems which arise; also that the low bidder has the same quality control system imposed as on the original supplier.

The low bidder has only one incentive—to produce at the lowest possible cost; his nameplate is not even used on the completed part.

Before contracting with a low bidder for supply of replenishment spare parts, the Military usually performs a facilities survey. This consists, for the most part, of evaluating his manufacturing and production capability. Engineering capability is lumped into this study as one of the 15 production items. In the financial capability area, the Small Business Administration can override any military decision by issuing a Certificate of Confidence.

The Military concern for reliability is expressed further in Air Force regulation 375-5 issued Oct. 17, 1960. This new regulation places a dollar value on reliability.

AMC Regulation 57-6, published February 2, 1960, states, "Replenishment spare parts determined to be producible by the commodity industry will be coded for competitive procurement except when personal safety or operation of the equipment might be jeopardized, and the parts would require data and/or expensive special tooling for economic fabrication. Dynamic (moving) parts will not be coded for advertised procurement unless interchangeability can be assured . . . Caution will be exercised in reviewing drawings, to assure that all notes are reviewed so that non-standard requirements are not overlooked."

Who does this coding—considering all the factors involved?

#### SMALL BUSINESS

With this need for reliability, the Congress, The General Accounting Office and the Small Business Administration still foster the idea of buying replenishment spare parts on a low-bid basis—no consideration given to factors other than price.

Small business is willing to compete, but those with engineering capability do not want to furnish their designs to those with only machine shop capability.

#### REPORTS ON RELIABILITY

A publication of interest is a 2-volume study entitled "Parts Specification Management for Reliability", published May 1960 and generally referred to as the "Darnell Report". This study concerned primarily electronic components such as resistors, capacitors and diodes.

Among their conclusions:

"The purchase and use of reliable parts by the Military Services must be effectively controlled to prevent the substitution (by 'consolidation' or 'equivalence') of a part with lower or no specified life expectancy."

Bogus parts do exist. Some examples are pointed out in "The Problem of Bogus Parts" (1957) by Joseph M. Chase, Flight Safety Foundation, Inc., who says, "The problem of bogus parts is serious because it is almost impossible to detect some of the phonies without extensive tests few of us are equipped to make. Many of the counterfeits are skillfully fabricated. Some carry the inspection marks and part numbers of the genuine articles. Some are even packaged like the original. Some differ from the part produced by the prime manufacturer only in material, a difference often extremely difficult to discern."

#### INDUSTRY VIEWS

The prime contractors are loathe to comment on the subject of reliability of replenishment spare parts. They do not wish to endanger their relationships with the Military Services. Unofficially, they feel the problem began about a year ago when the Congress, the General Accounting Office and the Small Business Administration pressured for procurement on an advertised-bid basis. Most of the specialists in spare parts feel it will be another year before we have true reliability data on this equipment from operational use.

Reliability starts with the original design. But should this be further diluted by unreliable spare parts?

#### Industry offers:

1. Advertised-bids should be relegated to the nuts and bolts class and these should be tested and inspected carefully prior to acceptance. This applies to AN, MS, NAS and JAN parts. The specifications do not determine the level of reliability.

2. Other parts of a non-critical nature can be procured by competition under the negotiated-competitive-bid system. First choice for such bids should always be the already approved, qualified vendor who has previously expended money to qualify the design, to prove its compatibility with the system, who also has the know-how to make the articles, and who has the established quality control system.

3. To assure reasonable pricing of negotiated bids, the government now has the authority and the organization to audit the books of a contractor; namely, the individual Military Service auditors, the General Accounting Office, the Renegotiation Act and Redetermination procedures.

4. Technical advancements will be made so long as there is competition. The negotiated-competitive-bid retains this concept.

5. Engineering and design capability are as important as machine tools and dollars in evaluating a bidder's facilities.

6. Permit the company, who develops a product with its own private capital, the right to keep its proprietary data.



# Spincraft reaches new heights

Man—carefully packaged in a metal gondola—has soared to record-breaking heights above the earth.

Spincraft has long been a prime source of expert counsel and skilled craftsmanship for the nation's astrophysicists. It was natural, therefore, for the designers of these gondolas to call upon Spincraft for the intricate fabrication of metal parts.

Whether or not your metal forming needs are as dramatically newsworthy as "Operation Man High," you may be sure Spincraft will solve them just as successfully—probably with improved design and lowered costs, too.

Write for Spincraft's Notes for an Engineer's File, a series of bulletins to keep you abreast of the latest metal spinning advances at Spincraft—the world's largest metal spinning plant.



4129 W. State Street, Milwaukee, Wisconsin

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## Integral Flywheel-Blower Helps Hush Power Mower Engine

**Silencing Requirements Lead to New Design, Low-Silhouette Gasoline Engine with Components below Deck**

Lars G. Soderholm, Midwest Editor

A new, four-cycle, single-cylinder, air-cooled engine, developed primarily for use in rotary power mowers, uses a novel combined cast-aluminum flywheel-blower which is located below the engine and under the mower deck. The flywheel-blower casting also has a cast-in permanent magnet for use with the magneto-type ignition system. These developments resulted from an overall program to produce a quiet power mower.

It was found that above-deck noises could be reduced by placing a cover over the engine to confine the noises inside. The flywheel and the blower, components that normally sit on top of the engine, were moved below the engine as part of the redesign. Initially, work on the blower was started using a multi-blade turbine-type blower wheel. Since the

air flow over the engine was on the suction side of the blower and the blower had to handle hot air, securing adequate cooling was a problem. A single-duct blower design was tried which turned out to be quieter and more efficient than the previous test models. The single-duct combined blower and flywheel lent itself nicely to casting. To counterweight the ducted portion of the flywheel, a permanent magnet was added which provides the necessary pole pieces for the ignition system. With so many component parts moved below deck, a lower silhouette was achieved, making shrouding practical. The air flow for cooling was changed to permit the use of a single, muffled air inlet in the shroud.

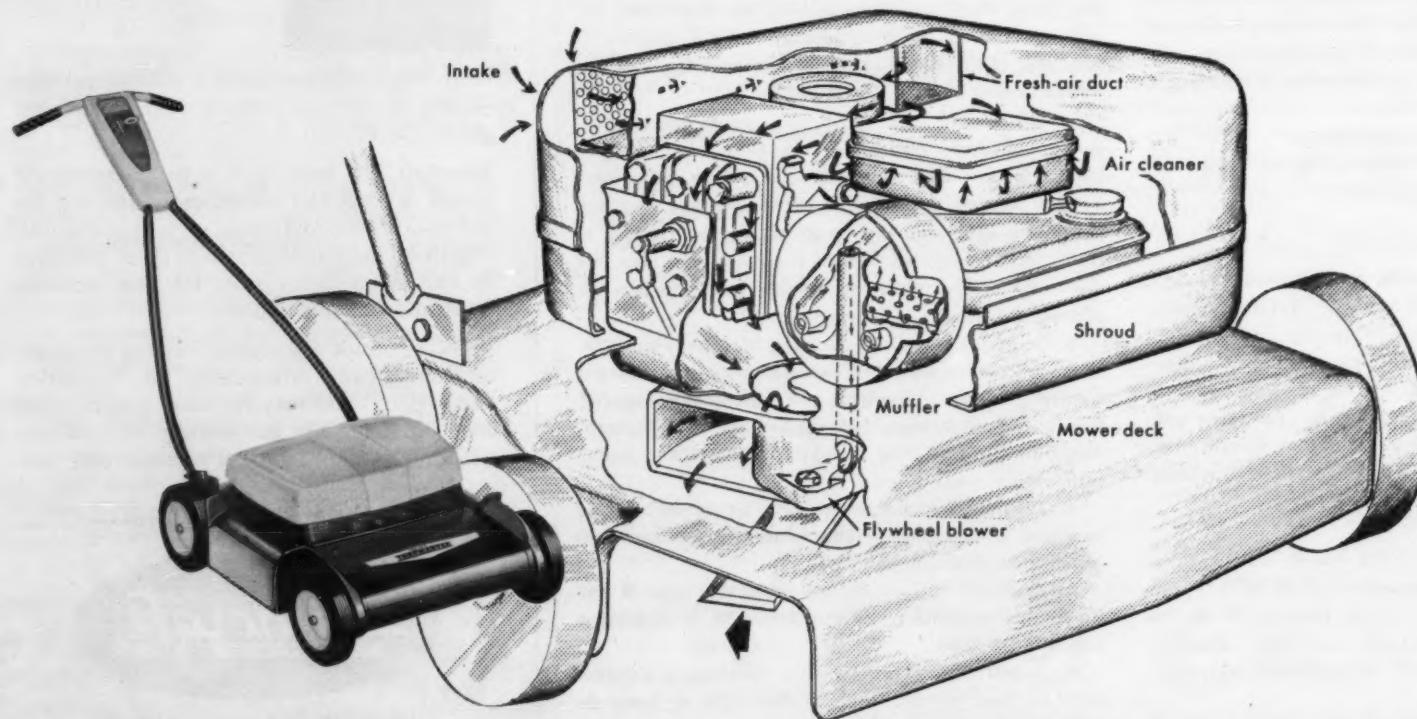
All air is exhausted below the mower deck. Cool-

ing air is discharged from the rapidly rotating flywheel-blower. Engine exhaust is passed through a three-stage, two-compartment muffler and discharged through an elbow under the mower deck to prevent damage to grass.

The result of this work on the engine along with vibration isolators and a quiet-operating cutter blade produced a mower that had its objectional noise range reduced from 16 to 6 ft.

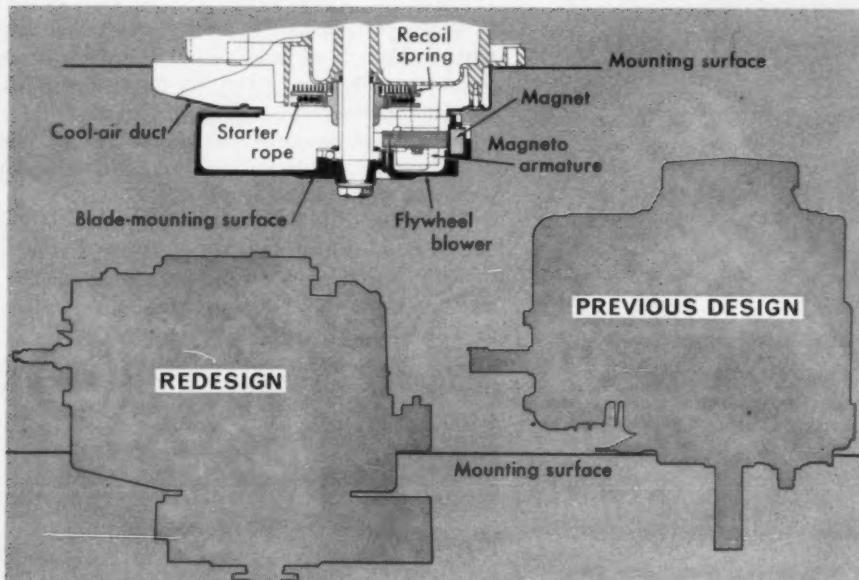
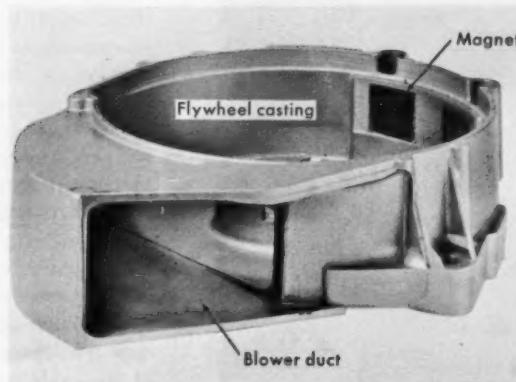
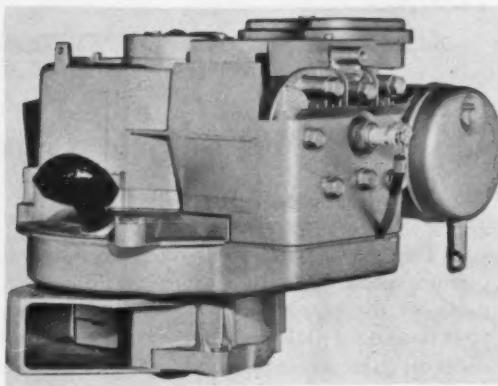
The new low-silhouette engine is a 7.75-cu-in displacement, 4-cycle, single-cylinder, air-cooled unit weighing 19½ lb. It develops up to 3 hp at 3600 rpm. It is comparable to the standard engine in all respects including price.

The "Sonoduct" gasoline engine was developed by the Briggs & Stratton Corp., Milwaukee, Wis.



**HUSHED POWER MOWER** which uses new engine has low-silhouette styling. Mower shown is "Turfmaster" by Dille & McGuire Mfg. Co., Richmond, Ind.

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**LOW-SILHOUETTE ENGINE DESIGN** places most components below engine and under mower deck. New design results in (1) savings in space, (2) lower sound level, (3) lower center of gravity and (4) additional flywheel functions (starter ratchet, blade coupling). Size comparison of standard and low design engine shows space savings obtained.

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DESIGN NEWS—JANUARY 16, 1961

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IDEAS . . .  
MECHANICAL DEVICES

### Sliding Block on Preform Press

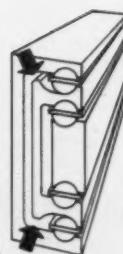
E. J. Stefanides, Central States Editor

A sliding sleeve block is used in an automatic preform press to measure phenol-resin powder, transport the powder to a die chamber and to eject completed preformed discs. The sleeve block slides on guide rods between the upper and lower hydraulic rams. It is actuated by a pneumatic cylinder through a simple lever.

At the start of the cycle, the sleeve is positioned beneath the hopper where it fills with resin molding powder. It then moves forward, transporting the powder to the die chamber formed by the retraction of the lower ram. After dropping the powder into the chamber, the block immediately moves back to its initial position beneath the hopper. The upper ram then moves down, compressing the powder into shape at approximately 6000 psi, dwelling for several seconds under load after which it raises. Lower ram then elevates the completed preform to the table top and stays in position until the block moves forward on its next cycle. When the block moves forward its leading edge pushes the completed preform over the edge of the table to a conveyor belt. The lower ram then descends to form the cavity for the preform powder.

The entire action is controlled by limit switches which energize the hydraulic and pneumatic circuits through solenoid valves. The timer is adjustable to allow for a variable dwell of the upper ram. This is necessary to achieve best results with different preform size and material. The lower ram has an adjustable stroke which is varied by means of an adjustment screw.

This press is used for preforming material for bakelite discs which are then placed in a heated mold. It was designed by the engineering department of Dimco Gray Co., Dayton, Ohio, for use in its own plastic-molding department.



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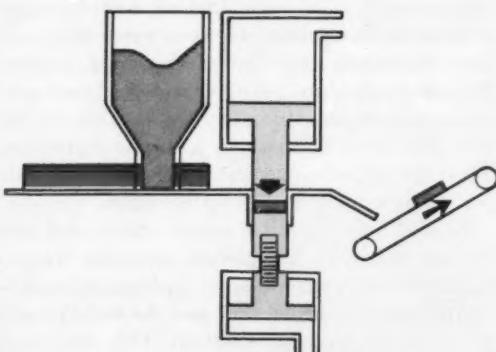
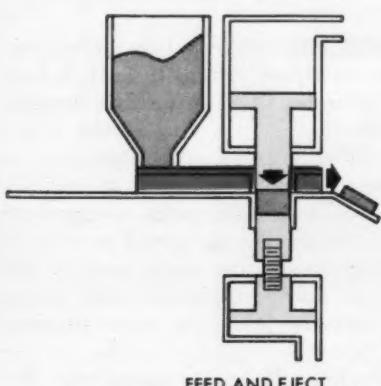
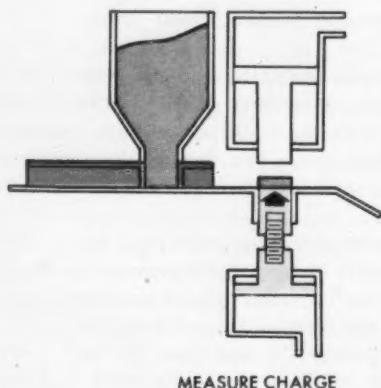
GRANT PULLEY & HARDWARE CORPORATION

Eastern Division / 19 High Street, West Nyack, N.Y.  
Western Division / 944 Long Beach Ave., Los Angeles 21, Calif.

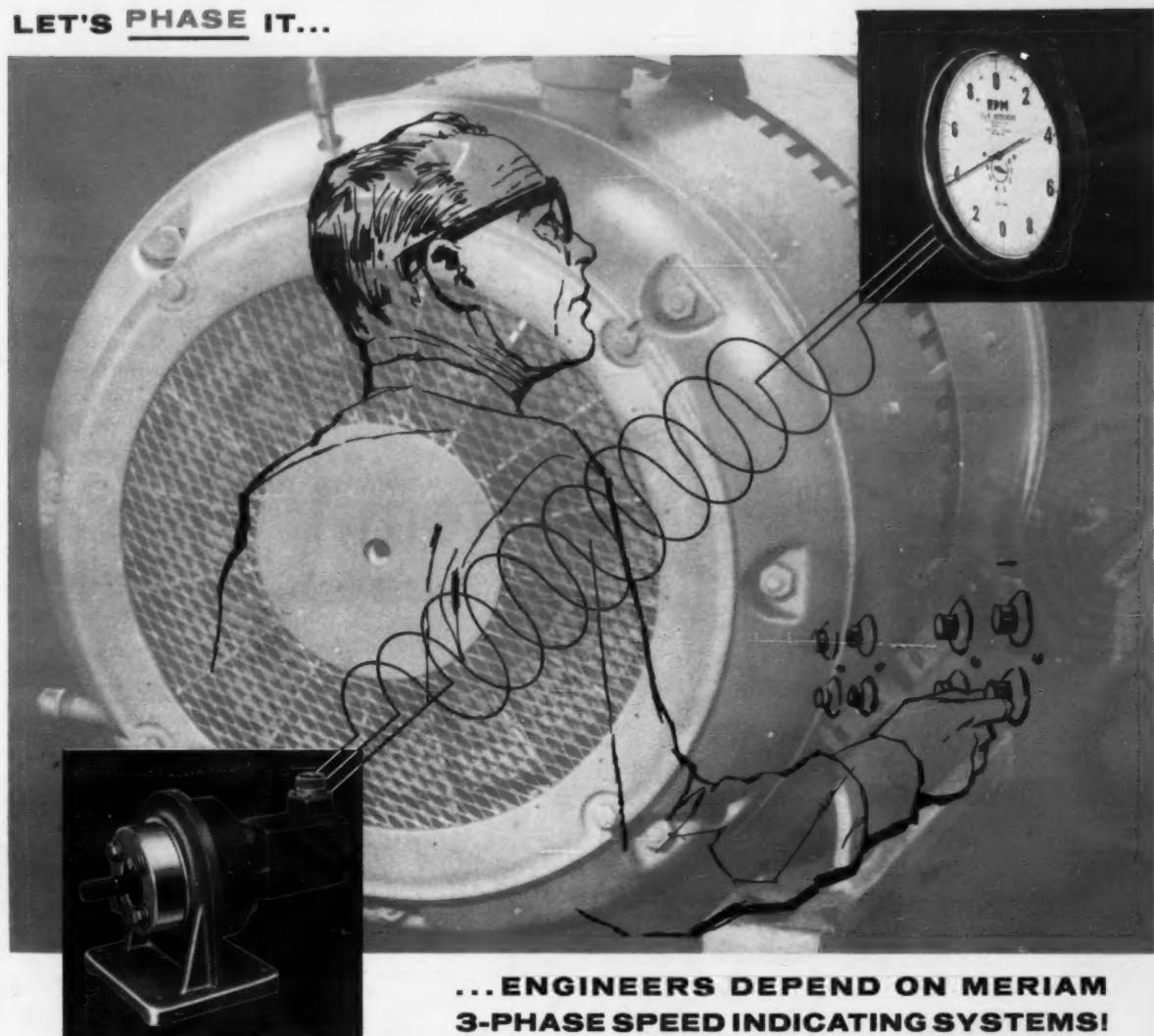
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**LET'S PHASE IT...**

## Measures, Feeds and Ejects



SLEEVE BLOCK slides on guide rods between upper and lower ram, is actuated by pneumatic cylinder through simple lever. Upper and lower rams are hydraulic powered, lower ram is adjustable to allow thickness adjustment. Variations in diameter are accomplished by means of cavity liners and various diameter ram heads. Work cycle is controlled by switches and electric timer. Timer control is necessary to allow suitable dwell periods for the setting up of the materials.



## ... ENGINEERS DEPEND ON MERIAM 3-PHASE SPEED INDICATING SYSTEMS!

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**IDEAS . . .****MECHANICAL DEVICES****Pressure Balances**

Edward W. Schrader, Western Editor

Differential pressure of fluid admitted to a standpipe balances spring force on pilot valve, which in turn operates the main poppet valve, to control tank fluid level. The floatless level control valve represents a new concept in fuel level control.

Fuel pressure enters the valve inlet and briefly opens the main poppet until pressure increases sufficiently on the other side of its diaphragm. Fuel enters the chamber behind the main poppet through a passageway and past the ball pilot valve. As air in the system is displaced, fuel enters a second diaphragm chamber through a small passage.

When this second chamber is full, the fuel proceeds up the standpipe, causing hydrostatic pressure in the chamber. This hydrostatic pressure, multiplied by the effective area of the second diaphragm assembly, causes an upward force on this diaphragm. In approximately 10 seconds, this upward force becomes equal to the weight of the diaphragm assembly plus the spring force on it. The second diaphragm then moves upward. The 10-second delay in opening occurs only during the initial operation when the valve chambers are dry.

As the diaphragm assembly moves, the pressure-balanced pilot valve lifts off both its seats. This closes the passage between valve inlet and first diaphragm chamber of the main poppet. With the ball of the pilot valve off its lower seat, pressure from the first chamber exhausts to the tank through a side passage to the main poppet. The inlet pressure may then push the main poppet off its seat, thus opening the valve.

By the time the valve opens, the second diaphragm assembly has gained sufficient force—usually about four inches of hydrostatic head—to overcome the spring rate, and the main poppet moves to the full open position. This simultaneous action is necessary to the operation of the mechanism. There is feedback control between the pilot valve position and the main poppet position.

The tank fills with the main poppet in the open position. Hydrostatic pressure from the tank, as it fills, operates on the back of the second diaphragm assembly. When the tank level is within approximately four inches of the top of the standpipe, spring force is in equilibrium.

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Of course, Garrett maintains complete stocks and sizes of many variations of flat nuts, "J" nuts, "U"—in both cone and twin-prong impressions — as well as round and rectangular push-on nuts for immediate delivery.

Garrett offers complete facilities, and exercises strict quality control in every manufacturing operation of spring fasteners . . . from stamping to heat treating through plating or finishing, including Garretizing, our own new mechanical impact method of zinc plating without hydrogen embrittlement.

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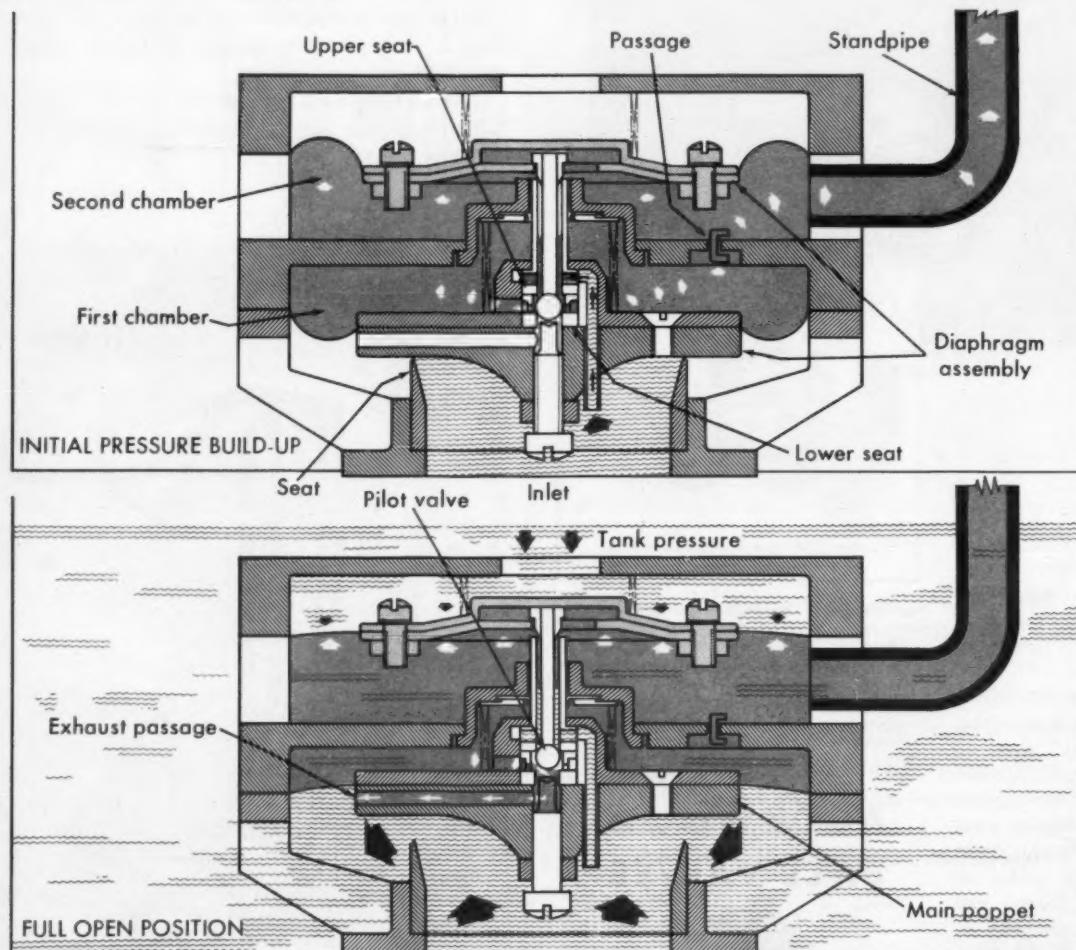
## Spring Force in Level Control Valve

Further filling results in the loss of differential hydrostatic pressure across the diaphragm. This smaller force against the pilot valve spring allows the spring to move the pilot valve to a new position of equilibrium. Because of the feedback mechanism between the main poppet and the pilot valve, the main poppet follows the pilot valve to the new position which is closer to the seat. This process of filling, loss of hydrostatic head, and closing of the pilot valve and the main poppet continues until sufficient loss of the differential head between the tank level and the top of the standpipe takes place

to drive the main poppet to the fully closed position against its seat. This closure normally occurs when the fuel level in the tank is approximately two inches below the upper end of the standpipe.

Length of the standpipe or pilot line is optional. It may lead to any part of the tank. Only enough fuel to overcome the force of the pilot valve spring is required in the pilot line.

The floatless liquid level control valve is a design of Whittaker Controls Div. of Telecomputing Corp., Los Angeles, Calif.

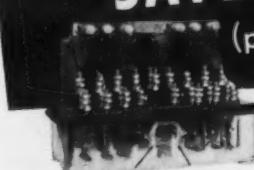


FLOATLESS LEVEL CONTROL VALVE controls final shut-off level to  $\pm 0.1$  inch of any desired level with flows from 0 to 200 gpm and with deadhead pressures varying from

10 to 50 psi. Low surge pressures are obtained by feedback control which causes position of main poppet to be function of tank level.

**Conversion to  
Metal Powder  
SAVES \$1.76**

(per piece)



Made of Nickel  
Silver Powder  
This Precision  
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1 1/4 "

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- ... . Better Finish
- ... . Lower Cost

General Railway Signal Company designed this Locking Dog for its Type K Interlocking Relay used to control railroad crossing signals.

It was formerly made of extruded brass, sawed to thickness, drilled, profiled, filed, polished and plated at a total cost of \$2.20 per piece.

Produced by a custom metal powder fabricator,\* the part is now delivered, ready for assembly, at a cost of 44¢ per piece!

Nonferrous powder metallurgy can produce accurate, cost-saving parts for your products as well.

\*Merriman Bros. Inc., Boston, Mass.



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# They broke up the pellet traffic jam . . .

IDEAS . . .

MECHANICAL DEVICES



## with Rockwood Ball Valves

A costly and recurrent problem in a large southern synthetic fibre mill was the jamming of polymer pellets as they came from supply hoppers. Source of the trouble was the tapered-throat design of the valves. Even with valves fully open, pellets piled up. In addition, this packing-in action caused severe abrasion on the valves. The problem was solved by replacement with Rockwood Ball Valves. Their straight-through-opening feature now permits pellet to flow smoothly . . . and the wear problem has been automatically eliminated because Rockwood valves offer no more resistance to flow than the pipeline itself.

What's more, after hundreds of openings and closings Rockwood Ball Valves still provide positive leak-proof

shut-off means. A retainer spring, which automatically compensates for pressure variations keeps the seat snug against the ball and holds tight even under vacuum.

Thousands of Rockwood Ball Valves are giving efficient service and cutting costs throughout industry — in oil refineries, textile mills, paper, chemical and rubber plants.

There are types and sizes to meet every requirement in your plant. Write today for the illustrated folder on Rockwood Ball Valves. Tested and listed by Underwriters' Laboratories, Inc. Rockwood Sprinkler Company, A Division of The Gamewell Company, 847 Harlow Street, Worcester 5, Mass. Distributors in principal industrial areas.

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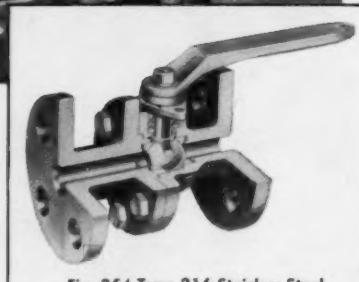


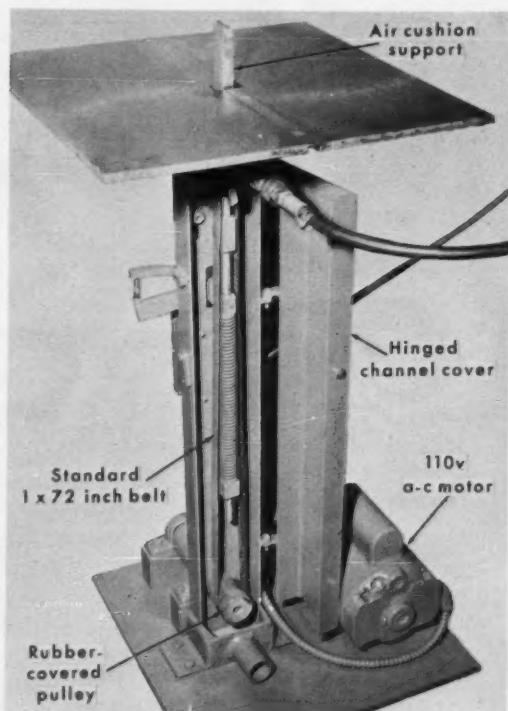
Fig. 254 Type 316 Stainless Steel

Rockwood Ball Valves are available in pipe sizes  $\frac{3}{8}$ " through 16" in screwed ends 150 lb. and 300 lb. flanges. All internal parts are of Type 316 stainless steel with spring-compensated TEFLO<sup>N</sup> seats. Recommended for 600 p.s.i. working pressure and suitable for temperatures ranging from -100° F. to 400° F. All sizes are available with two retainer springs and two Teflon seats.

\*DuPont Reg. T. M.

## ROCKWOOD BALL VALVES

FULL, ROUND FLOW



VERTICAL SANDING MACHINE will operate in  $\frac{3}{8}$ - by 1½-inch slot. Table may be raised or lowered to fit depth of part being sanded as well as tilted 45 deg to either side. Normal sanding speed is 3700 fpm.

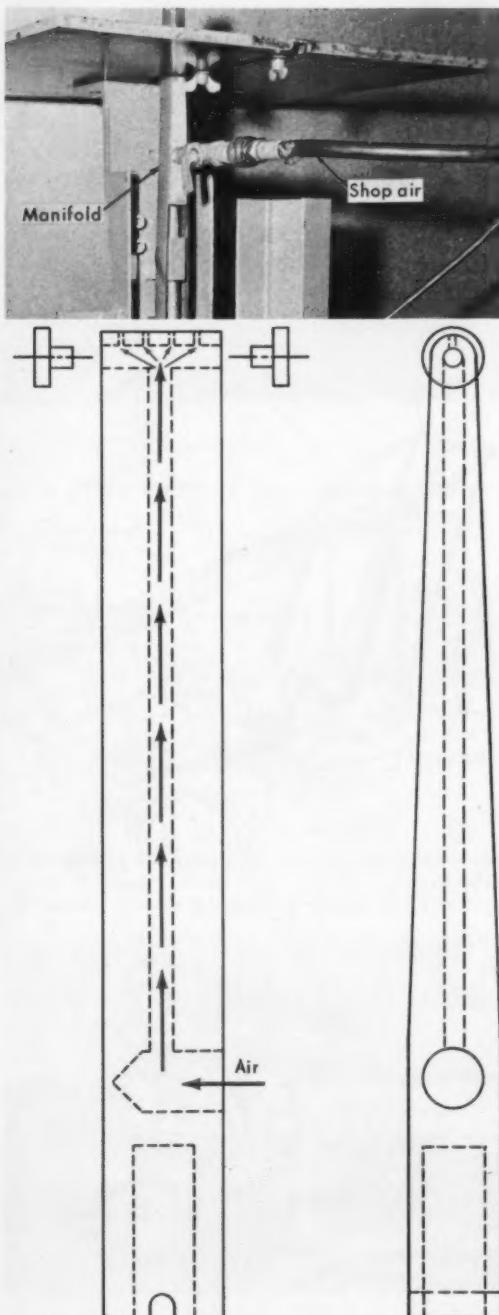
## Air Cushion Supports

Robert L. Candlish, Detroit Editor

An air cushion support is substituted for a pulley on the working end of an endless belt sanding machine for snagging and deburring die castings. Regulated factory air is fed under the belt through the combination belt support and guide and floats the belt up clear of the guide. This substitution eliminated a small-diameter pulley that in the past had been troublesome because of its high rotating speed and the contaminant in which the pulley operated. The belt is motor-driven at the lower end by a large-diameter rubber-faced pulley. Sander uses standard 1- by 72-inch belts available in various grits. Belt tension is maintained by spring-loading the entire manifold and top support.

The air-supported belt vertical sander is manufactured by the Service Machine & Supply Co., Holland, Mich.

## Belt on Vertical Sander



FOUR HOLES in top of belt guide bleed air under moving belt. Lateral guides plug open ends of air supply manifold.

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Your IRR Distributor carries Industrial Pre-Stacked Retaining Rings . . . or, write us for complete information.

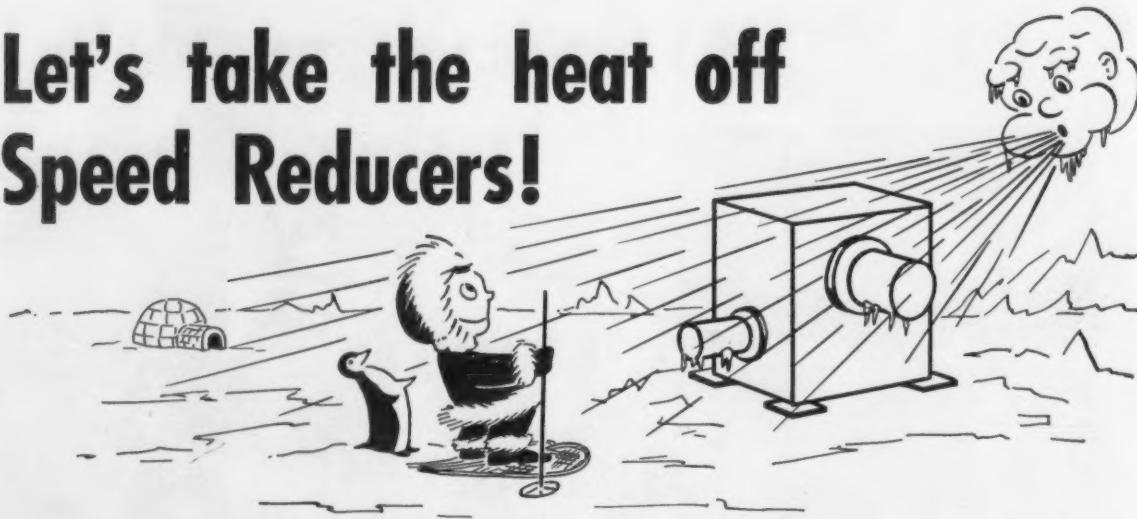
Send for Catalogs No. 30D and 31D.

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# Let's take the heat off Speed Reducers!



**A**wful gear speed reducer is one of the toughest little customers in captivity. It reduces speeds day-in, day-out, with little complaint. While it works long and hard, it has limitations—set by ratio, center distance, RPM, mechanical and thermal HP ratings, etc. And, depending upon how precisely it was selected and fitted to the job requirements, it will do what it has to do.

But sometimes it's forced to play outside of its league. It must cope with job requirements that vary from here to there—normal 8 to 10 hour service without recurrent shock, the same length of service where there is some shock loading, continuous low-speed service and almost countless others. But the thing that really puts the pressure on reducers, the thing that's lurking in every set of job requirements—is h-e-a-t.

When you exceed the thermal capacity of a reducer for more than an hour or so, excessive temperature thins the lubricant resulting in wear; material, bearing and oil seal failures; etc. Of course, the proper lubricant will help but it can't cure the continuing problem of excessive heat.

So how can we lick this toughy? One way is to build the reducer housing oversize, big enough to radiate the heat away and keep temperatures down. But this type sticks out in aisles, louses up compact designs and barks shins. Then, we might try a smaller housing complete with fins on it to dissipate the heat. If this still doesn't work, another trick is to use a reducer with capacities and ratings a step above the ones we need. This is sending a man to do a boy's job. It's impractical, inefficient

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and costly. There *has* to be an easier, better, saner and cheaper way to do it. And there is!

In certain cases, where the size and type of reducer permits and where we can gain enough in thermal HP rating to keep heat generation in bounds, Cone-Drive Gears does it with fan-cooling.

What's that? Simple. Just add a fan to the worm shaft plus the necessary air shields, fan cover, etc., and presto!—heat is no longer a problem. The air shields direct the fan-pushed air over the fins on the lower portion of the reducer. The fins are shaped and spotted to guide the air stream where it is needed. Thermal HP ratings are boosted tremendously, as high as 147% above those of standard reducers in some cases! Those over-worked, over-heated reducers will now do the job you bought them to do.

Other advantages? They're here in abundance. The size of the reducer stays the same. All parts on a Cone-Drive fan-cooled reducer are 100% interchangeable with parts for standard reducers. Oil capacity is identical. Shields are quickly removed without disconnecting the reducer. (This is important where severe operating conditions make periodic cleaning necessary). The reducer can also be operated *without* fan-cooling just by taking off the fan and shields.

This simple addition to standard Cone-Drive HU speed reducers might be just your answer—might save you some money. Write for Cone-Drive's Bulletin CD-218. It will tell you all about the full line of Cone-Drive double-enveloping worm gear reducers as well as the fan-cooled kind. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

## IDEAS...

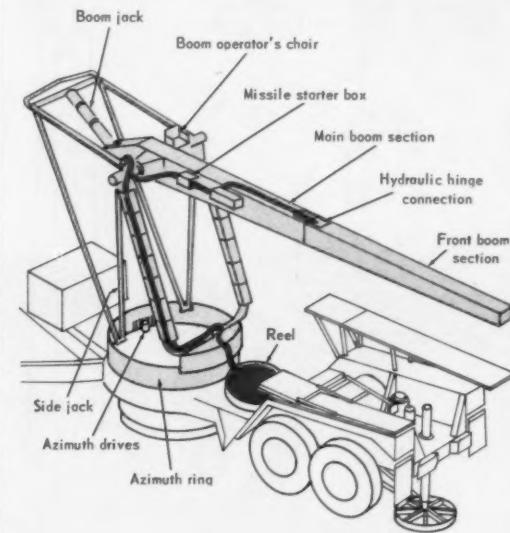
### MECHANICAL DEVICES

#### 'S'-Path Keeps Constant Force

Edward W. Schrader, Western Editor

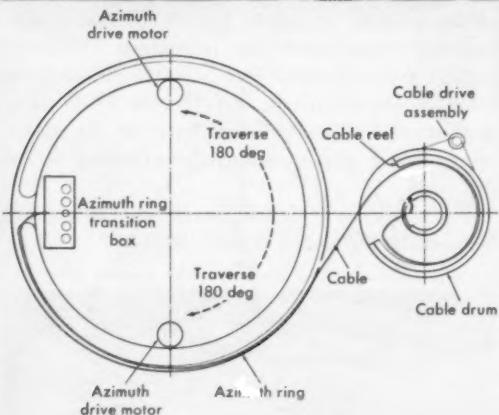
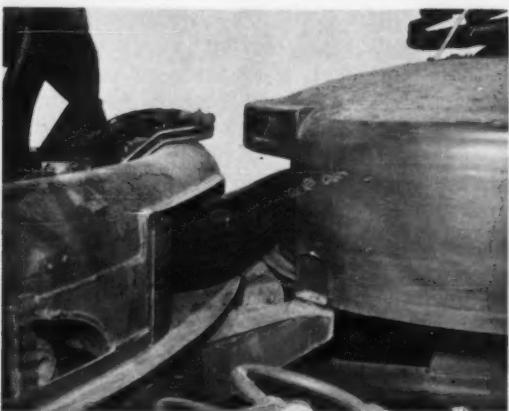
The "S" path of the electrical cables between the cable reel and the azimuth ring of the Army's Sergeant missile erector-launcher assembly allows the erector-launcher to move 180 deg either side of normal position without snarling electrical cables.

A hydraulic motor applies a 500-lb-in torque to the cable reel, tending to wind up the electrical cables. The variable displacement hydraulic motor allows fluid to bypass under a locked reel



ERECTOR-LAUNCHER ASSEMBLY FOR SERGEANT GUIDED MISSILE uses boom to carry missile. Assembly rotates on azimuth ring for ease of assembling missile and launching. Electrical cables pass from cable reel to azimuth ring.

## on Cables for Sergeant Launcher



CABLES pass in S-shape from cable reel to azimuth ring and up U-frame to boom. Eight individual covered cables lie flat and move as belt between rotating members.

condition. When the erector-launcher assembly is rotated, the torque of the azimuth drive motors overpowers the applied torque to the reel and draws the cable from the reel when the launcher is rotated to the desired azimuth for firing.

From the azimuth ring, the electrical cables are threaded up one side of the U-frame to the boom which carries the missile.

The Sergeant Guided Missile is in production at the Sperry Utah Engineering Laboratory, Salt Lake City, Utah. The surface-to-surface medium-range ballistic missile system is being developed and designed under the cognizance of the Army Ballistic Missile Agency, an element of the Army Ordnance Missile Command which is now supervising the production program.

# SAVE TIME, AIR, MONEY

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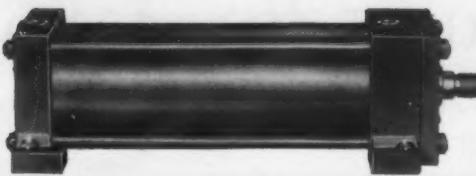
Your pneumatic system shapes up faster at the design stage when one man can discuss with you every component you'll need. But have you realized how much your Parker-Hannifin man can save you in money and air?

Just for instance . . . your valves don't have to be  $\frac{3}{4}$ " just because the cylinder size you select comes with  $\frac{3}{4}$ " ports.

Your Parker-Hannifin man chooses valve types and sizes to suit the air flow you'll need. He'll show you too, how pressure control saves money and air, how a smaller lubricator is often a more efficient lubricator, and other money saving ideas. Then he'll show you ways to "tube up" and "hose up" a leakproof pneumatic system quicker, neater and at lower cost.

Call your nearest Parker-Hannifin sales office, or write direct for complete information.

2139-PH-a

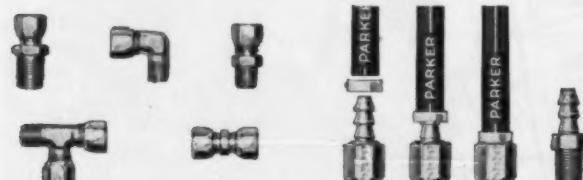


Low friction, long packing life are money-saving features of the Hannifin Series "A" pneumatic cylinder, available in a full range of mounting styles and from  $1\frac{1}{2}$ " to 14" bore, strokes to 20 feet. Hannifin cylinder application data and charts make selecting the right Series "A" cylinder easy. Get yours from your Parker-Hannifin man.



DUAL SOLENOID, PRESSURE, HAND, 4-WAY  
4-WAY, 3-WAY

Use flow factors as money-savers—your Parker-Hannifin man can show you how. They help you to avoid "oversizing" your valves. Hannifin's new Valve Finder gives "Cv" ratings for every valve in the line, makes it possible for you to take full advantage of the extra air-flow capacity in Hannifin air valves. Get your copy today.

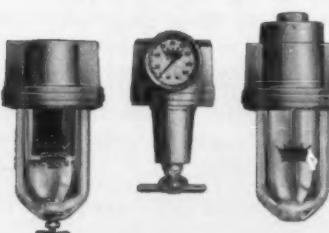


Pneumatic systems tube up fast with Parker "Intralok" tube fittings. Use them with copper, nylon or "Parker-POL" polyethylene tubing. Just insert the tube and tighten the nut for a leakproof "bite-type" joint.

Another time-saver is "Push-lok", the Parker hose-and-hose-fittings combination for pressures to 250 psi. No tools needed. Just push this hose on these hose fittings. They won't blow off, ever, not at twice 250 psi.



One air line connection installs the Hannifin Air Motor...an integral solenoid valve controlling a fast, rugged double-acting air cylinder. Built-in speed controls adjust piston speed in either or both directions.



You will save both air and money with Hannifin "Crown" air line filters, pressure regulators and lubricators. Let your Parker-Hannifin man show you how they pay for themselves by making it possible to get all the air flow you need at the exact pressure that will best do the job. "Crown" filters and lubricators will bring further savings through reduced equipment maintenance.

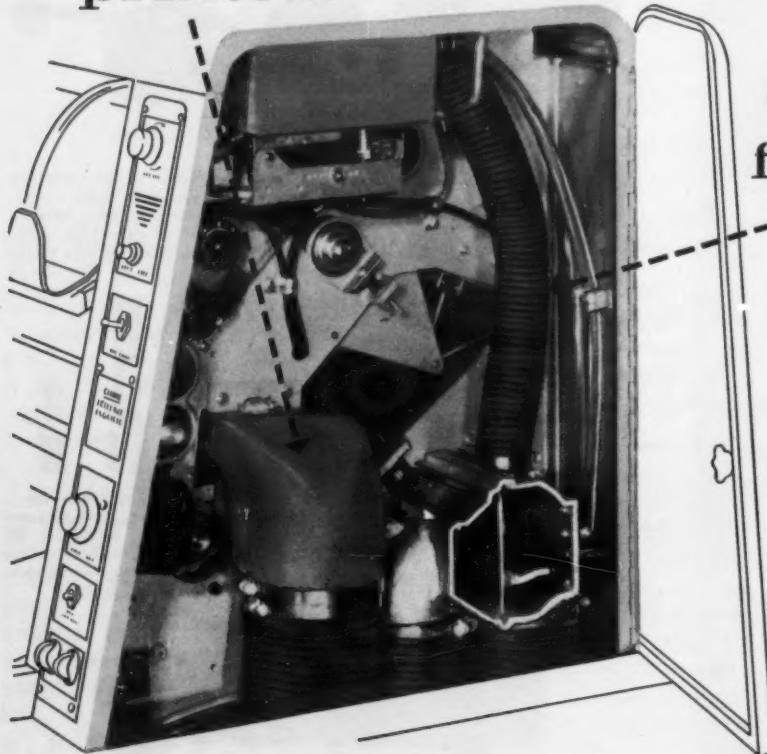


**Parker FITTINGS AND HOSE DIVISION**  
17325 Euclid Avenue • Cleveland 12, Ohio  
**HANNIFIN COMPANY**  
A DIVISION  
535 South Wolf Road • Des Plaines, Illinois  
**PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS**

Circle 16 on Reader-Service Card for more information

# In the Lancer Whiteprinter, Flexible Tubing

1...provides suction to separate originals from prints...



**Proof that Flexible Tubing can solve a wide range of design problems**

Copymation, Inc., designers of the LANCER Dry Process Whiteprinter, had to solve three tough air handling problems: how to provide suction... how to convey air for cooling... how to exhaust heat and fumes — all in a very limited space!

Solution to all three problems: a rugged nonmetallic duct with a wire helix — Flexible Tubing's "Flexflyte." Flexflyte is air tight and non-collapsing — provides strong, continuous suction for separating originals from prints. Flexflyte is lightweight and highly flexible — easily conveys air through cramped areas. Flexflyte is flameproof and corrosion-resistant — safely exhausts heat and fumes. Perfect example of the design problems solved with Flexible Tubing!



Circle 17 on Reader-Service Card for more information



2...  
conveys air  
for cooling...  
  
3...  
exhausts  
heat and  
fumes

IDEAS...  
MECHANICAL DEVICES

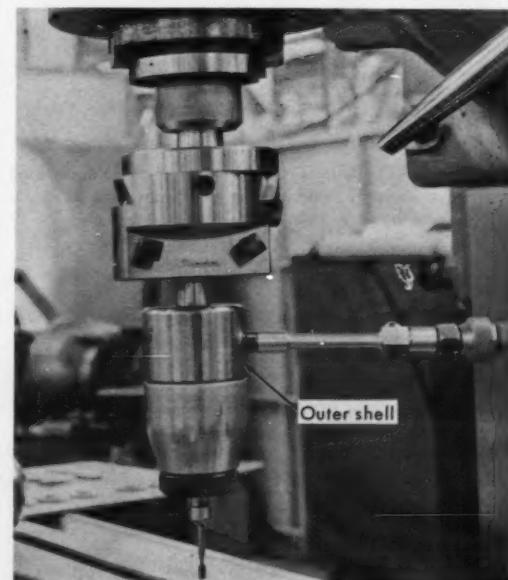
## Oscillating Shell Feeds

Celestino O. Lubatti, Italian Editor

The outer shell is an annular feed chamber for a grinder's air-motor, whose rotor and stator both turn. The motor stator is chucked eccentrically in a boring head so that the complete unit is swung through repeated planetary feed circles during operation. Although swung through these circles as well, the shell does not rotate and air feed to it is through a simple flexible hose. The design gives the advantages of high-speed air-powered precision grinders for finishing holes and recesses in hardened steel without requiring complicated modifications and accessories.

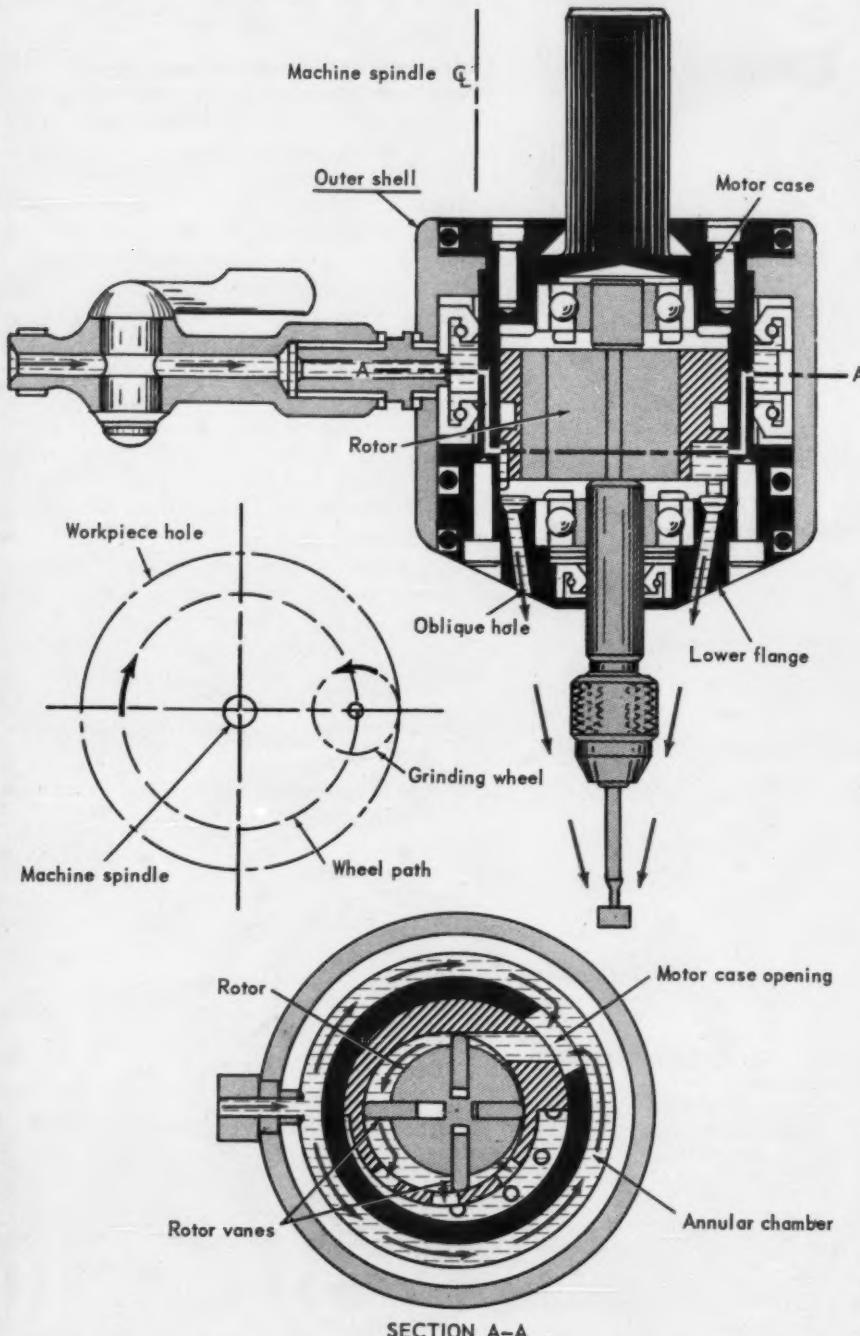
Air from the feed chamber passes through the motor inlet into a tangential passage of the impeller cylinder, or stator. It hits the radial-vane impeller tangentially for maximum efficiency and later is exhausted into a spiral manifold in the stator, between case and cylinder. From there it passes downward through bores in the motor case, cooling and cleaning the grinding wheel and work.

The unit is a development of Costruzioni Meccaniche Brosi Sas, Turin, Italy.



**GRINDING UNIT** for hole finishing or rectification of center distances fits conventional boring head on milling machine. Flexible pipe attached to plug cock feeds 71-psig pressure to air-motor developing up to 100,000 rpm. Compressed air exhausted by motor (6.35 cu ft per minute) provides automatic cleaning and cooling of grinding wheel.

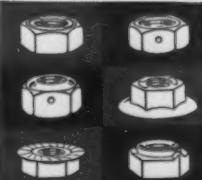
## Air-Motor During Planetary Travel



**NON-ROTATING ANNULAR CHAMBER** feeds air to motor while motor case stator revolves with moderate speed about milling machine spindle. Milling machine operation pro-

vides feed for grinder. Planetary motion with variable grinding-wheel offset permits finishing of holes to desired diameter. Shank attaching to boring head is integral with motor case.

One



of these  
CAN IMPROVE YOUR  
PRODUCT...

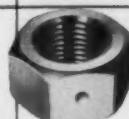
### SIX GREAT MACLEAN-FOGG LOCK NUTS

#### MF UNI-TORQUE



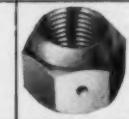
A free starter with lock at the top. Withstands severe vibrations. Cuts assembly time.

#### MF TWO-WAY



The Lock's in the center of nut. Can be applied from either end. Permits bolt end to be flush with, or below, top of nut.

#### MF OPEN END CAP NUT



Has two-way center-of-nut lock. Used on furniture, appliances, toys, lawn mowers, tools, etc.

#### MF UNI-TORQUE FLANGE NUT



Combination lock nut and washer. Use on oversized holes; where extra bearing surface is needed.

#### MF "WHIZ-LOCK" FLANGE NUT



This one spins on. Serrations take a firm grip on work. Break loose torque higher than seated torque.

#### MF PILOT TYPE WELD NUT



You can have it with or without lock. Simplifies assemblies by means of self-locating pilot.

CIRCLE NUMBER FOR ILLUSTRATED CATALOG



# MACLEAN-FOGG LOCK NUTS

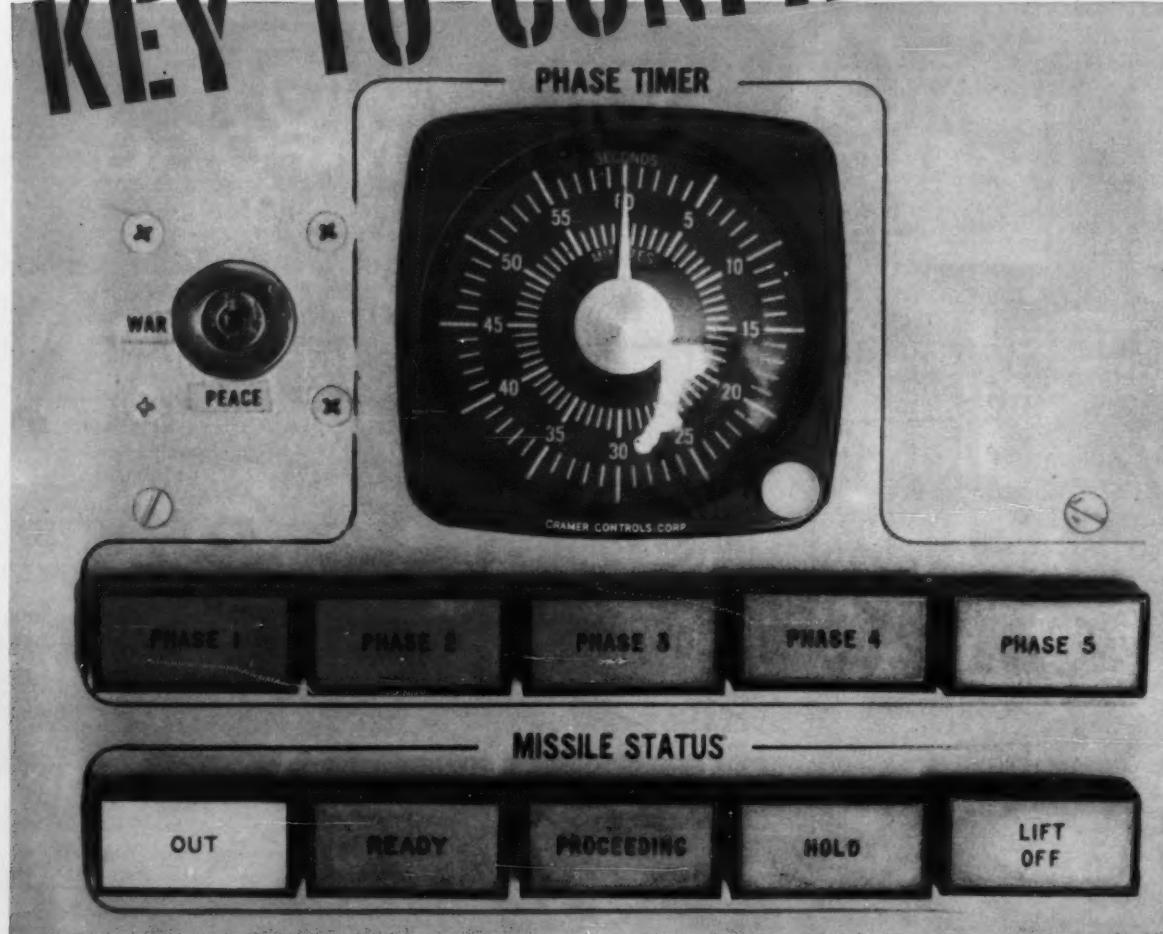
MacLean-Fogg Lock Nut Company

5535 N. WOLCOTT AVENUE  
CHICAGO 40, ILLINOIS

Need Lock Nut  
Advice? Phone  
ED 4-8420 (Chicago)  
Collect.

Circle 18 on Reader-Service Card for more information

# KEY TO CONFIDENCE



## CRAMER TYPE 691 PRECISION TIME TOTALIZER

This is a ballistic missile control panel, somewhere in England. You may have seen it in a recent issue of either of two leading weekly news magazines... and read about two keyslots: "War-Peace", to permit activation of the atomic warhead, and "Launch Sequence", to initiate the intricately synchronized steps that lead to lift-off.

Once that sequence is started, each of the five phases of the 15-minute countdown is completely automatic, precisely indicated by a Cramer Type 691 Time Totalizer. Human hands begin the cycle, and may stop it before the fateful last minute. But no hands are deft enough to guide it through its complex dance.

Here, as in many less dramatic instances, the key to confidence is a Cramer timing device.

ELECTROMECHANICAL DIVISION

**CRAMER CONTROLS CORPORATION**

CENTERBROOK, CONNECTICUT

Circle 19 on Reader-Service Card for more information

## IDEAS...

### MECHANICAL DEVICES

## Refrigerated Shelves Improve

Lars G. Soderholm, Midwest Editor

An automatic-defrost freezer utilizes both refrigerated plates inside the food compartment and an evaporator coil in the air duct for cooling. The cold evaporator coil picks up moisture from air in the compartment and is defrosted regularly by an attached heating coil. The refrigerated plates maintain even, low temperatures in the food compartment and permit quick freezing of foods.

The usual refrigeration cycle calls for a cold surface to be located in the circulating air stream. The cold surface removes moisture from the air which is deposited on it as frost. A fan moves the chilled air into the food compartment.

The limitation of this system is that the circulating air, its moisture removed by the cold surface, will tend to dehydrate frozen food. Large air flows aggravate this condition. Also during the defrost cycle, if chilling is supplied by the cold surface alone, the temperature of the food compartment tends to rise until the cold surface is defrosted and the compressor is switched on again.

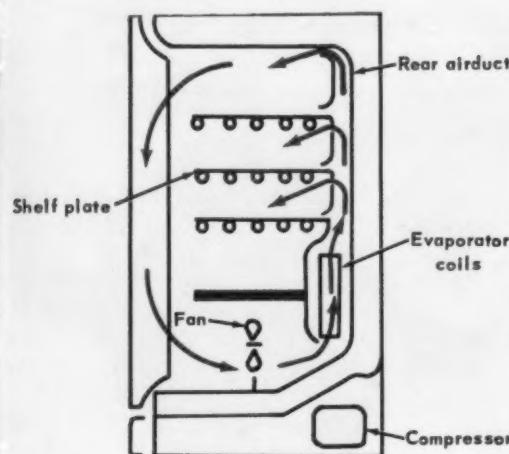
To overcome some of these shortcomings, refrigerated shelves were incorporated into the freezers. These permit food to be frozen quickly and relieve the cold-surface evaporator coil of part of the cooling job. This permits air circulation to be reduced to just enough to keep the temperature even and guarantee no frost collection in the freezer.

During a defrost cycle, the compressor and air-circulating fan stop and the heating coil is energized. When the heating coil has had a chance to defrost the evaporator coils, the entire system goes back into operation again.

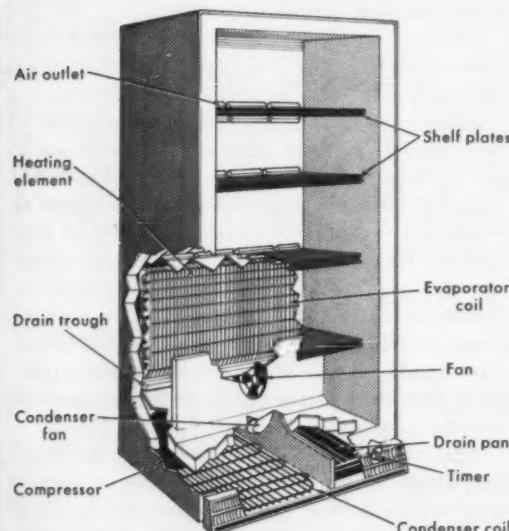
The "Free-O-Frost" system was developed for freezer and combination units made by Amana Refrigeration, Inc., Amana, Iowa.



## Automatic Defrost System

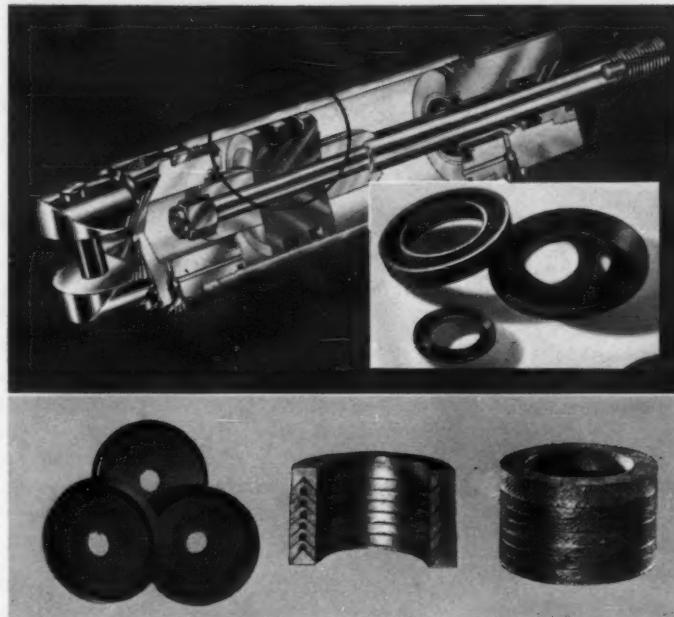


**AUTOMATIC DEFROST FREEZER** using combination of freezing shelf plate and cold evaporator coils is shown in diagram. Air circulation is by fan blowing air from lower portion of freezer up over cold surfaces of evaporator coils and through air duct. Openings at rear of food compartment permit air to pass over food toward front of box and down to repeat cycle.



**POSITION OF COMPONENTS** in freezer shows evaporator coil in lower rear portion of box with heating element passing through it. Temperature of evaporator coil is kept 8 to 10°F lower than refrigerated shelf plate temperature. In defrosting sequence actuated by timer, compressor stops, heater coil is turned on; frost and ice run down into drain trough; when thermostat on evaporator coil reaches 60°F, power is switched from heater to compressor.

## ENGINEERED PRODUCTS for Hydraulic, Pneumatic Service



Garlock "U" Cup and "V" Ring Packings (top) provide tight sealing, help increase efficiency of famous Tomkins-Johnson "Spacemaker" cylinders. Garlock molded cups (bottom left) and CHEVRON\* Packings are also specified for air and hydraulic cylinders.

Tomkins-Johnson standardizes on Garlock "U" Cup and "V" Ring Packings for their famous "Spacemaker" air and hydraulic cylinders.

On a wide variety of "Spacemaker" applications, Garlock packings provide leak-proof service against air, water, and hydraulic fluids at temperatures to 250°F, pressures to 1000 p.s.i. Tomkins-Johnson specifies Garlock products because of their greater flexibility, minimum friction, and resistance to sudden shock loads.

**Garlock "U" Cup Packings** are specially designed for proper fit against the cylinder wall—this prolongs service life to a maximum. Available in several materials and designed to JIC standards, the cups are applied on diameters ranging from 1" through 14". Flexible and resilient Garlock "V" Ring Packings respond quickly to low gland and fluid pressures, offer positive, low friction sealing at all pressures. Available in various materials and sizes.

Enjoy the same advantages that Tomkins-Johnson does—standardize on Garlock hydraulic-pneumatic packings. Garlock's complete line also includes widely-used CHEVRON\* Packings with an exclusive hinge-like construction that "rides" with the pressure . . . tightens as pressures increase, eases off as they decline . . . results in positive sealing with little friction. Garlock Molded Cups provide maximum efficiency in sealing air and hydraulic cylinders over a wide range of service conditions.

For more information, call your local Garlock representative at the nearest of our 26 sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalogs AD-163 ("U" Cup

# GARLOCK

Packings) and AD-115 (CHEVRON Packings). Garlock Inc., Palmyra, New York.

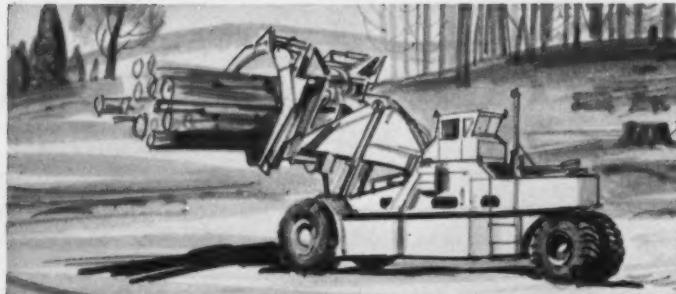
**Canadian Div.:** Garlock of Canada Ltd.  
**Plastics Div.:** United States Gasket Company

**Order from Garlock 2,000 . . .** two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products

\*Registered Trademark

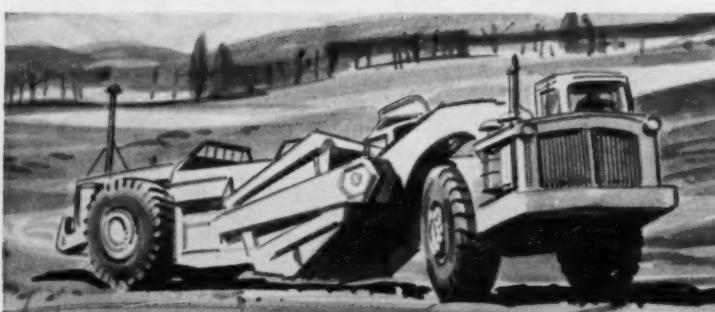
Circle 20 on Reader-Service Card for more information

# ALLISON speeds big loads **TORQMATICALLY**



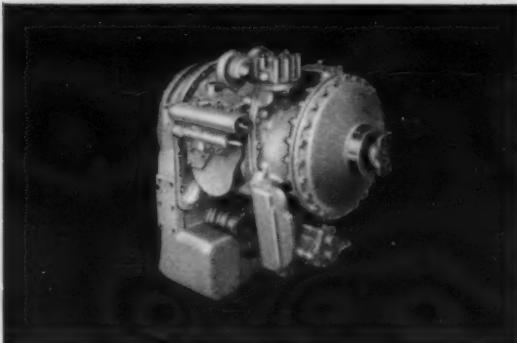
## IN "LUMBER JACKS"

Despite a 70,000-lb. lift and carry capacity, the Wagner LJ 3-70 Lumber Jack is designed for fast work in mass-production operations. Its CRT-5630 TORQOMATIC DRIVE lets the operator quick-shift at full throttle to speed loads—one reason why it is standard equipment in this machine.



## IN TWIN-POWER SCRAPERS

One contractor who owns a Euclid TS-24 Twin-Power scraper reports: "One Twin is equal to five 130-h.p. crawlers with 10-yd. tow-type scrapers." Another says: "One Twin is equal to three 12-yd. self-propelled scrapers plus pusher." Typical? You bet. And the CRT-5630 is one of the TORQOMATIC team members that make twin power possible.



## IN ANY 200-300 H.P. UNIT

For that scraper, king-size loader or four-wheel prime mover, you'll find faster job cycles and lower maintenance costs with the job-proved CRT-5630 TORQOMATIC DRIVE.

It has 3 speeds forward and 3 reverse, planetary direction and range gearing, transfer gearing drop box incorporating front- and rear-output flanges. With six choices of TORQOMATIC converters to give that perfect engine match, the CRT-5630 is ideal for a wide range of machines and jobs.

Want more information? Send for the fact-packed CRT-5630 brochure today.

Allison Division of General Motors  
Dept. DN-2, Indianapolis, Indiana

Please send me application data on your  
CRT-5630 TORQOMATIC DRIVE.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



**Allison** TORQOMATIC<sup>®</sup> DRIVES

The world's most complete line of hydraulic drives

Over 980 models used by 108 manufacturers in  
100 to 525 H.P. equipment

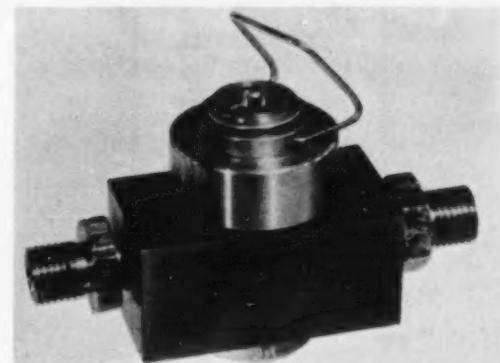
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## IDEAS . . .

### MECHANICAL DEVICES

## Integral Diaphragm Increases

Ronald W. E. Martin, British Editor



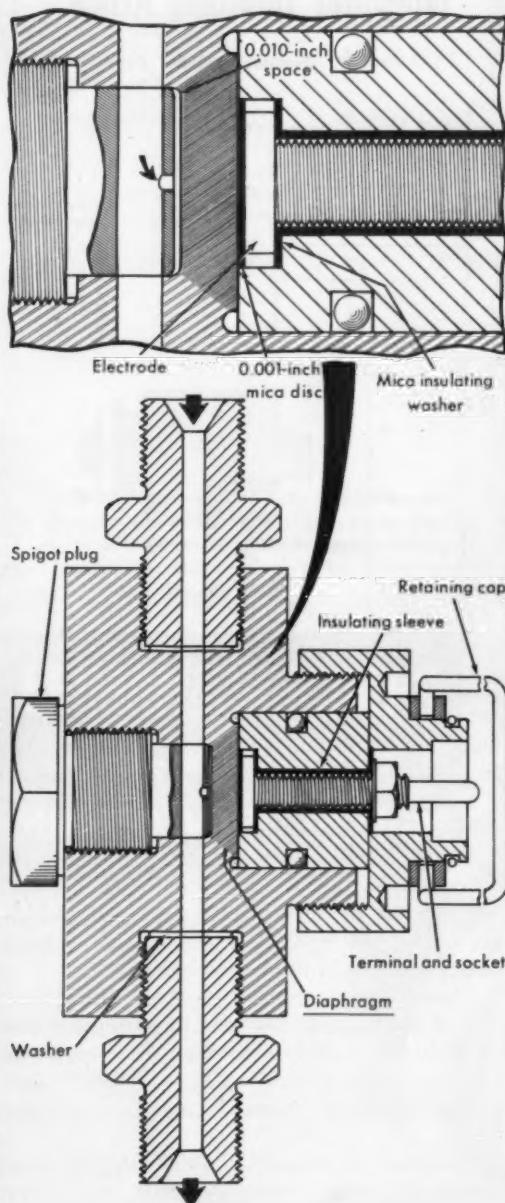
The pressure-sensitive diaphragm of a capacitance-type fluid-pressure pick-up is designed as an integral part of the instrument body. Fluid pressure acts directly on the diaphragm which forms an impenetrable barrier between the fluid on the one side and dielectric space on the other. Capable of measuring fluid pressures up to 15,000 psi, the pick-up is intended for checking diesel engine fuel injection systems.

The body incorporating the diaphragm is made from a good-quality die steel. The diaphragm section is machined to a thickness suited to the working pressure range, and the side adjacent to the electrode is ground flat and lapped to a mirror finish. Held in position by a cap nut, the electrode holder is hardened and ground and its inner end is lapped to a flat surface. The electrode is insulated with mica washers and insulating sleeve (the latter serving to centralize it). Finally it is faced and polished to give approximately 0.0015-inch clearance with the diaphragm. On assembly, a disc of clear mica approximately 0.001 inch thick is inserted between the electrode and the diaphragm.

The hole through which the fuel side of the diaphragm is machined is closed by a screwed plug having a close-fitting spigot, the length of which clears the diaphragm by 0.010 inch. The resultant small space formed is connected to the fuel line by a short hole of 0.031 inch dia. Thus, the additional volume to the delivery line is very small and has a negligible effect on the pressure conditions. The fuel pressure pick-up was designed by The British Internal Combustion Engine Research Association, Slough, England.

1761-1961

### Range of Pressure Pick-Up



**SMALL ANNUAL SPACE** around root of spigot is minimized by inserting washers which are held loosely when plug is screwed home tightly. Seal is made, without any washer, at outside face of pick-up body, from which accurate depth measurements can be made conveniently. Through-hole forming part of fuel line is drilled in plug after it has been screwed into position. Use of an "O"-type sealing ring between electrode holder and body prevents oil seeping in from outside of unit.

# 200<sup>th</sup> Birthday OF A.W.FABER-CASTELL ...

*Producers of the nearest thing to perfection in a drawing pencil*

It is customary, on the occasion of a company's bicentennial, to talk about the traditions that made it great.

Nothing would make us happier than to talk about A.W.FABER-CASTELL's distinguished history. But it may be more important if we pointed out how CASTELL drawing pencils can further your career.

CASTELL's Black Gold graphite allows a creative man to express his profoundest ideas. It gives such a bold, black image, such density saturation, that sharp, crisp drawings are assured. Its light-proof adhesion produces the highest number of sharp prints per drawing — without loss of detail even after hundreds of reproductions.

CASTELL's low index of friction gives you smooth, chisel-point strokes and needlepoint for the most exacting detail. Its close-textured lead has great strength. The lead won't crumble, the wood won't splinter, even under heavy pressure.

CASTELL is consistently uniform — identical in every degree, from 8B to 10H. You can go back to an unfinished drawing months — even years later — without change in line width or color.

Because of this unvarying excellence, CASTELL is the nearest thing to perfection man has ever put into a drawing pencil. For the sake of your own career, you'd be wise to join the A.W.FABER-CASTELL family.

For those who prefer a lead holder, #9800SG Locklite Tel-A-Grade, with no-slip, functional grip gives you smooth traction and blessed comfort to your tired fingers ■ Castell Drawing Leads #9030, of identical quality and grading as Castell drawing pencils ■ Usable in all standard holders, but a perfect mate for Locklite ■ Available in a full range, from 7B to 10H, and a kaleidoscope of colors ■ Draws perfectly on all surfaces, including Cronar and Mylar base films ■



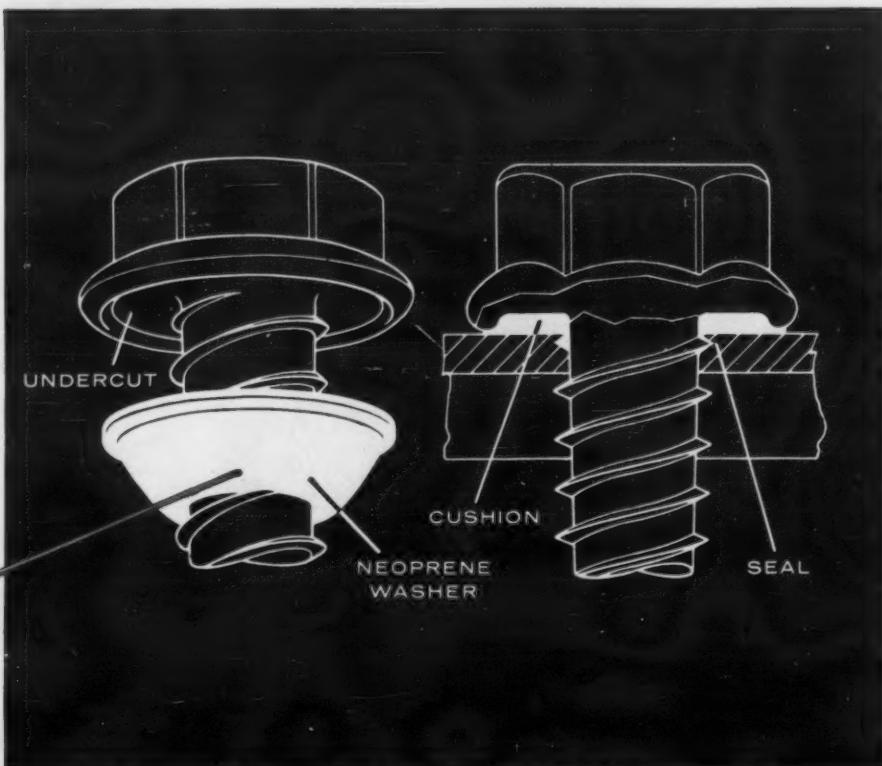
A.W.FABER-CASTELL Pencil Co., Inc., Newark 3, N.J.

OUR BICENTENNIAL YEAR — 1761 - 1961 ★ 200 YEARS OF UNINTERRUPTED MANUFACTURING EXPERIENCE.  
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A.W. FABER-CASTELL DRAWING LEAD 9030

NAT'S  
quick facts  
about  
Fasteners...



## With **TUFF-TITE** TRADEMARK Fasteners ...it's the **cushion control** that counts!

You can be very sure of this, in using Tuff-Tite® Cushioned Fasteners.

The preassembled neoprene washer won't ooze off in just any old direction when it's compressed under the head.

It will stay put and do what it's intended to do:

- Form a firm, even cushion under the head
  - Seal off the fastener hole
  - Prevent fluid leaking past the thread
  - Dampen vibration noises around the head
  - Protect fine finishes against marring and crazing
- ... because Tuff-Tite's undercut head and tough molded neoprene washer assure consistent cushion control. The undercut confines the spread as the washer is compressed, and the molded

shape guides the flow into the top threads, to seal the hole.

It's as simple and as certain as that, for any application requiring fastener sealing and cushioning. Tuff-Tite Fasteners\* are available as Machine, Self-Tapping, or Wood Screws, as Stove and Roofing Bolts, and can also be made as Special Fasteners. We'll be glad to work with you on your possible applications.

\*More details and specifications on standard types and sizes are given in the Tuff-Tite Fastener folder. Write for your copy.



**The National Screw & Mfg. Company • Cleveland 4, Ohio**

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

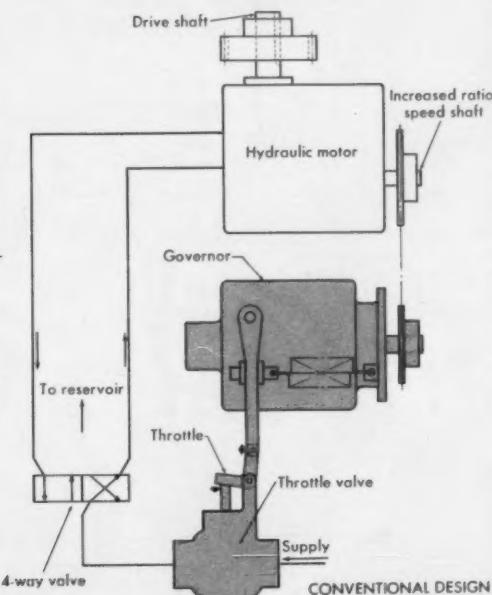
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## IDEAS...

### MECHANICAL DEVICES

#### Self-Propelled Governor Integrates Throttling Action

Victor W. Wigotsky, Eastern Editor



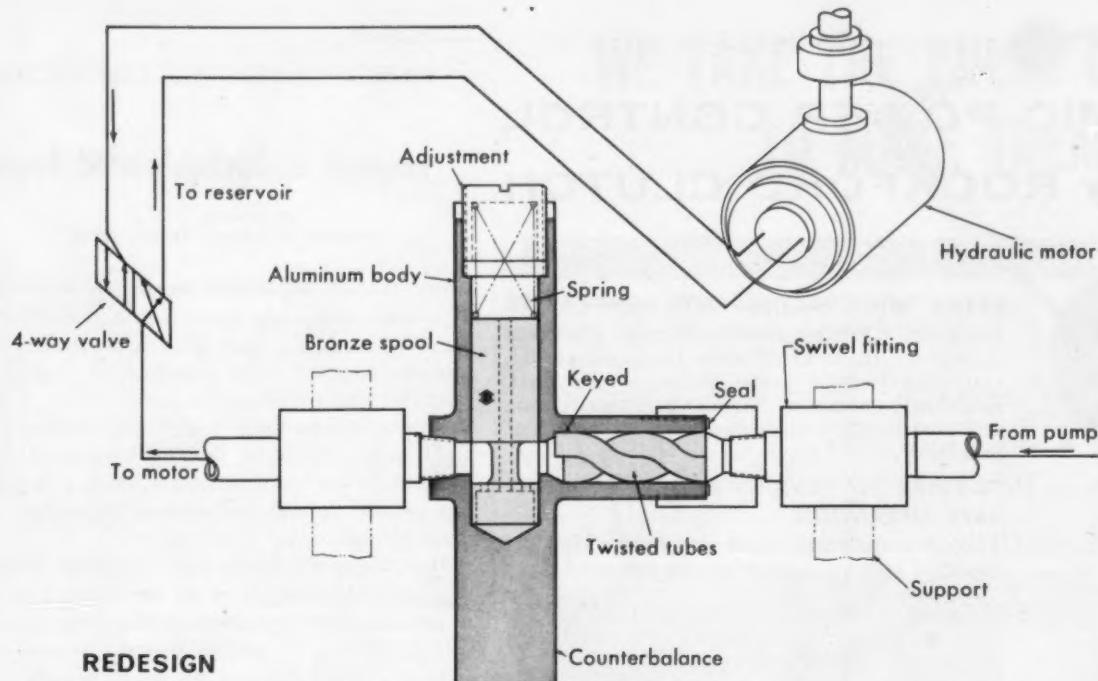
Flow through two twisted tubes operates a "self-propelled" governor. Unit functions without a transmission to drive it or an additional throttle valve in the pressure line.

A body houses a spring-loaded spool which intersects an orifice at its recessed neck portion. The inlet of the orifice retains two tubes which are twisted and keyed to body. Passage of fluid causes rotation of the entire unit.

Thus, when downstream pressure drops, rotation of the unit will increase. Centrifugal action of the spool then throttles the orifice until balanced. Amount of throttling is adjustable through the spring which resists the spool's centrifugal force.

The governor is used as a speed stabilizer of hydraulically driven objects. Normally, three separate elements would be required, consisting of a throttle valve in the pressure line, a governor to actuate the valve and a transmission to drive the governor. In the new device, however, throttling is integral with the governor and a connecting transmission is eliminated.

The self-propelled, governor-throttle valve was designed by Meir B. Shapiro, Design Engineer at Gibbs & Cox, Inc., New York, N. Y.



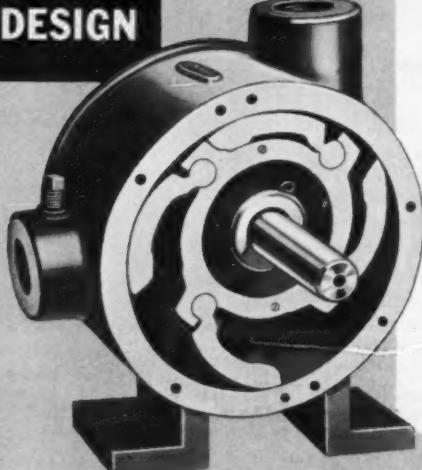
SPOOL OPERATES AGAINST SPRING, with variations in load, to throttle unit. Body spins in ball-bearing, swivel fittings as fluid enters orifice through twisted tubes. Governor requires no connection to motor. Parameters to establish

speed range include size of piping and pitch of twisted tubes, fluid and spring pressures, weight of spool and rpm of motor. Unit can operate with any fluid, where direct electrical powering is not practical.

## LEIMAN AIR PUMPS with the Exclusive HINGED VANE DESIGN

The simplified Leiman hinged vane design provides larger air space, higher capacity—permits use of smaller pumps, slower speeds, lower horsepower. Every pump rigidly test-run before shipment. Specify Leiman Air Pumps for your vacuum, suction or pressure operations for lifetime dependability. Consult Leiman engineers on any application.

WRITE FOR LATEST CATALOG and application book showing many how-to-do-it blueprints.



### WEAR-FREE! CARE-FREE! REPAIR-FREE!

#### Practically take care of themselves

**Self-honing surfaces.** Curved cast iron vanes rotating against cast iron cylinder walls hone wear surfaces to a hard, glassy smoothness. Provides continuous leak-proof seal and low-friction operation.

**Self-renewing vanes.** Cast iron vanes take up their own negligible wear. No composition tips to wear and renew. Provides years of new-pump efficiency.

**Self-oiling.** Leiman Automatic Oiler feeds the right amount of oil while running—needs no manual regulation—prevents over-oiling—reduces possibility of oil-staining.



**LEIMAN BROS., INC.**  
156 Christie St., Newark 5, N.J.  
Established 1889

**LEIMAN** **Rotary Positive**  
**AIR PUMPS**

Vacuum to 29.9" Hg. Pressure to 20 p.s.i.g. Volume to 162 c.f.m.

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DESIGN NEWS—JANUARY 16, 1961

## UNIVERSAL SELECT "O" RING KITS



*Fills Replacement Needs  
on 85% of All Industrial Equipment*

- ★ 180 "O" Rings in Each Kit—Sizes 1 to 25.
- ★ Patented Plastic Case Shows You "O" Ring Sizes in Kit at a Glance!
- ★ Interchange Data of All Leading "O" Ring Producers in Each Kit—All Manufacturers' Numbers Converted to Universal Numbers.
- ★ Buy Replacement Back-up Washers in these "O" Ring Sizes.

TEFLON . . . . .	\$115.95
BUTYL RUBBER . . . . .	\$ 47.95
STANDARD COMMERCIAL (Buna N) . . . . .	\$ 24.50
STANDARD SILICONE RUBBER . . . . .	\$ 66.90
VIM LEATHER BACK-UP WASHERS . . . . .	\$ 28.75
SELECT-O-RING KITS IN VITON . . . . .	\$124.50
AN 6227 SERIES . . . . .	\$ 59.50

### RETAINING RING ECON-O-KIT



### 400 Truarc Cadmium Plated Rings —84 Sizes—70% of Ring Sizes Used in Industry

Save—eliminate many purchase orders for small quantities of retaining rings—Get most sizes used on your equipment with only ONE order—in one shockproof, plastic case. Sizes from  $\frac{1}{4}$  to  $2\frac{1}{2}$  inches in the three most used Truarc series of internal, external and universal crescent ring designs. All rings meet National Aircraft Standards NAS 669 and NAS 670. Low priced at \$34.50 per kit.

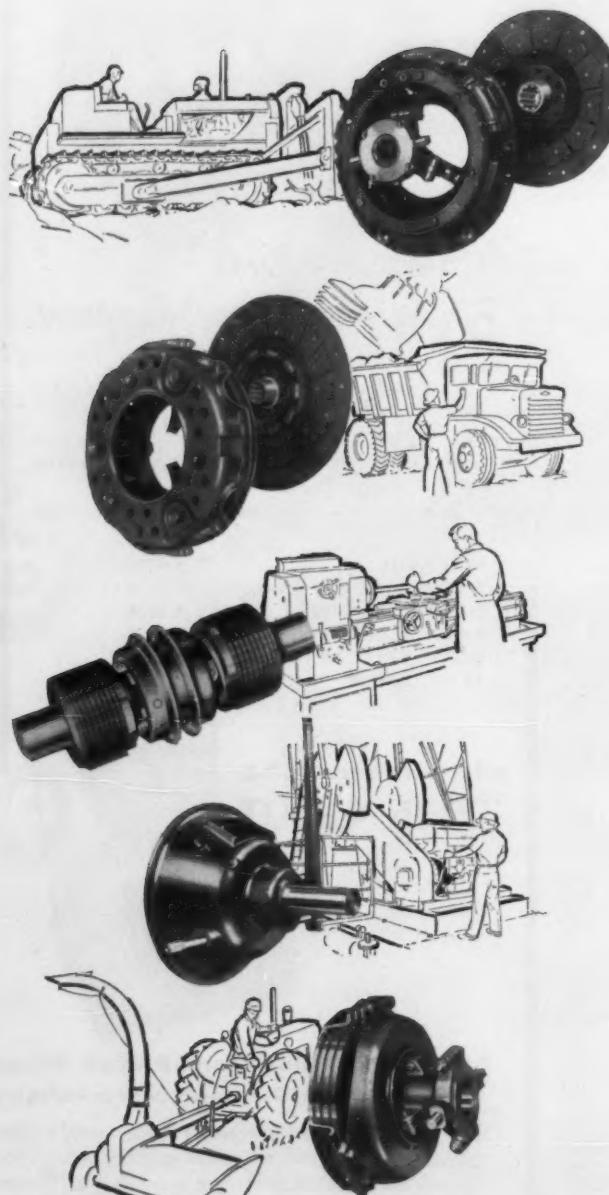
Installation and removal tools also available.

### Packaged Merchandise Co.

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## DYNAMIC POWER CONTROL by ROCKFORD CLUTCH



### EXTRA THICK FACINGS GIVE LONGER LIFE

Rockford Clutches have maximum thickness facings... up to 1/32" more friction material. Only the highest grade materials are used. Rockford's extra-long-life facings reduce scoring and greatly cut costs of downtime, replacement and labor.

### TORTURE PIT TESTING ASSURES SAFE OPERATION

Torture testing pits burst clutches to bits! At specified intervals, clutches are removed from the production line to undergo severe centrifugal tests. These clutches are spun to destruction but must withstand predetermined high speeds and specified time limits.

### STRONG CONSTRUCTION WITHSTANDS RUGGED SERVICE

Corrosion resistant discs are made of high carbon spring steel. Heat treated cast iron improves grain structure of pressure plates. Strong construction is Rockford's key to long and rugged service.

### VIBRATION-FREE CLUTCHES OFFER SMOOTHER ENGAGEMENTS

Smooth engaging Rockford Clutches are vibration-free! Rockford Clutch eliminates vibration through dynamic and static balancing. Clutch vibration can ruin bearings and crack housings. Minimum inertias prevent gear clashing and delayed shifting.

### PRECISE PRODUCTION MEANS PRECISE PERFORMANCE

Each Rockford Clutch component is precision built. Rotary surface grinding assures uniform thickness. Discs are checked carefully for dish and run-out. Inspectors check close tolerances for flatness by pressure and weight-drop drag machines.

If you need clutches for original equipment or for replacement, Rockford Clutch offers the highest quality in power control. From research to inspection, Rockford Clutches are designed and built for long, rugged and reliable service. Rockford offers an ultra-wide range of power controls for all industries. Write today for illustrated brochure.

# ROCKFORD CLUTCH

321 CATHERINE STREET, ROCKFORD, ILLINOIS

Export Sales Borg-Warner International • 36 So. Wabash, Chicago, Ill.

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IDEAS...

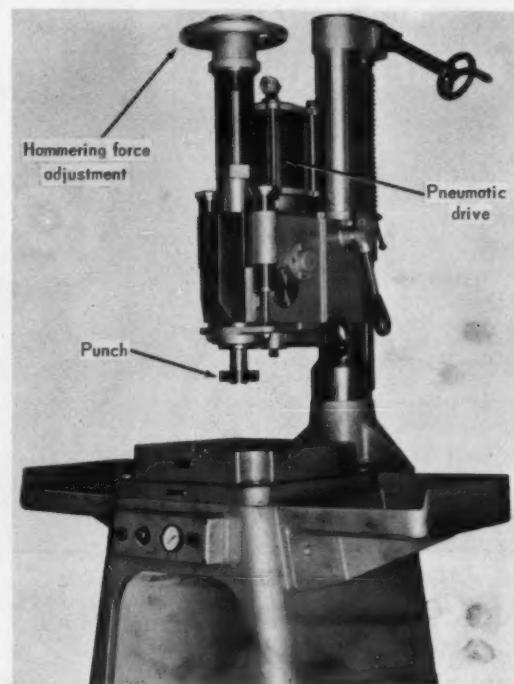
MECHANICAL DEVICES

### Spring-Loaded Sectors

Celestino O. Lubatti, Italian Editor

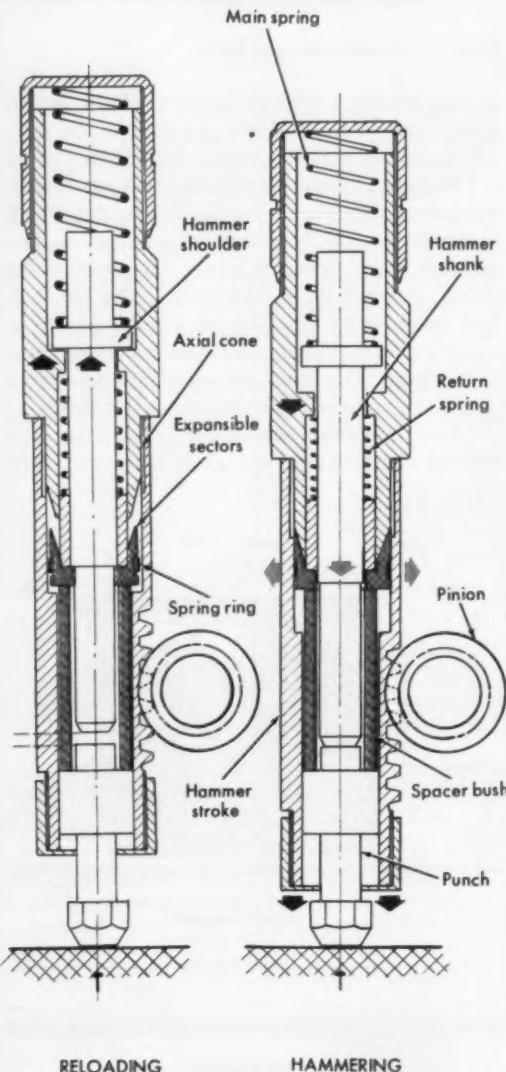
Three radially expandable sectors, spring-loaded by a ring, trigger the hammer of a riveting machine only when proper load is reached. This provides constant force regardless of workpiece thickness and punching frequency. Load is determined only by linear compression distance of main spring. A spacer bushing between sectors and punch sets hammer stroke, while a knurled cap permits accurate adjustment of preload on main spring.

Movements of hammer and trigger are limited separately by shoulders in the oscillating housing to permit proper operation of return spring. Resulting differential motion permits hammer retraction and relocking of the trigger sectors over the hammer-shank shoulder. In operation, a manually or air-operated pinion drops the punching head against the stationary workpiece. The spacer bushing keeps hammer and punch apart the distance of the hammer stroke until the housing release cone opens the sectors. Hammering force thus obtained depends exclusively on the axial load on the main spring. The riveting hammer is produced by Walco Srl, Milan, Italy.



# WE TAKE THE PULSE OF BEARINGS ON TAPE TO MAKE THEM EVEN BETTER!

## Trigger Preloaded Rivet Hammer

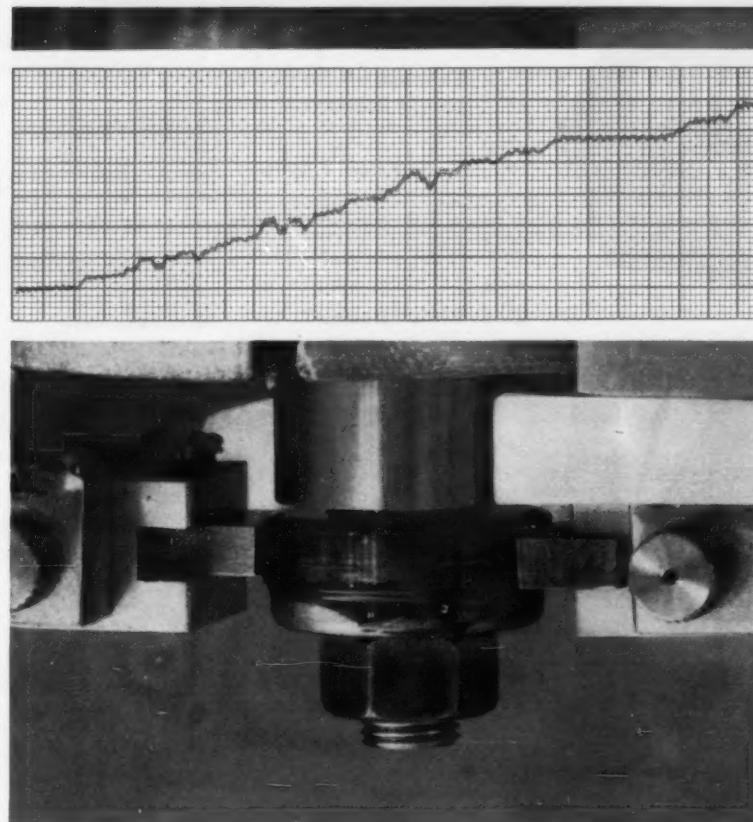


RELOADING

HAMMERING

**PUNCHING HEAD** is pressed down by handle-actuated pinion. Compression of main spring preloads hammer. As cone expands trigger sectors, hammer drops by fixed step depending upon height of spacer bushing. Return spring keeps punch down during hammering operation, facilitates separation on return stroke. At end of return stroke (upward motion of punching head) hammer is lifted by top shoulder to allow retraction of sectors against hammer-shank shoulder.

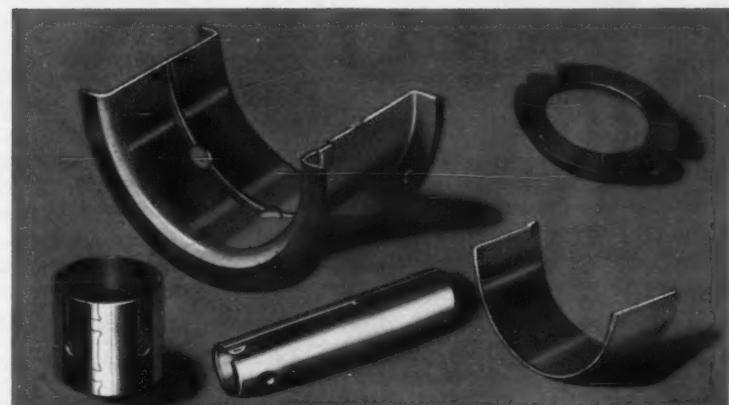
**PUNCHING MACHINE** utilizes spring-powered constant-stroke hammer whose force is manually adjustable within 3,000–10,000 kg (6,610–22,050 lb). Pneumatic drive permits 45 blows per minute with 120-mm (4.72-inch) punch stroke.



**TO TAPE-RECORD THE "HEARTBEAT" OF BEARING METALS UNDER LOAD, WE USE THIS SPECIAL FRICTION AND WEAR TESTER.** (left) The result is highly accurate data on the behavior of bearing-metal surfaces, invaluable in our fundamental research into friction. By means of this instrument, we're able to correlate, more closely than ever before, specific alloy compositions with their degree of the "stick-slip" phenomenon (in which one surface sliding over another slides . . . stops . . . slides . . . stops . . . and so on) which accompanies unlubricated sliding action. We can also determine accurately the compatibility of bearing materials with shaft metals in lubricated systems . . . showing us which metal or alloy is most likely to be superior for a given bearing application. In short, this Friction Tester is a fundamental research tool which gives us positive answers to difficult bearing problems, faster than ever before.

## ONE REASON WHY F-M SLEEVE BEARINGS

and other F-M products give you the finest possible performance — this and the other unusual precision equipment used by Federal-Mogul research. You'll find F-M sleeve bearings used in turbines, engines, and countless other types of power transmission equipment . . . F-M precision thrust washers in pumps, automotive engines and transmissions, motors . . . F-M formed bushings in refrigeration compressors, electric motors . . . and low-cost F-M spacers in motor mounts, machinery, control mechanisms. These are just a few examples.



There's much valuable data in our Design Guides on sleeve bearings, thrust washers, and bushings; and in our brochure on spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

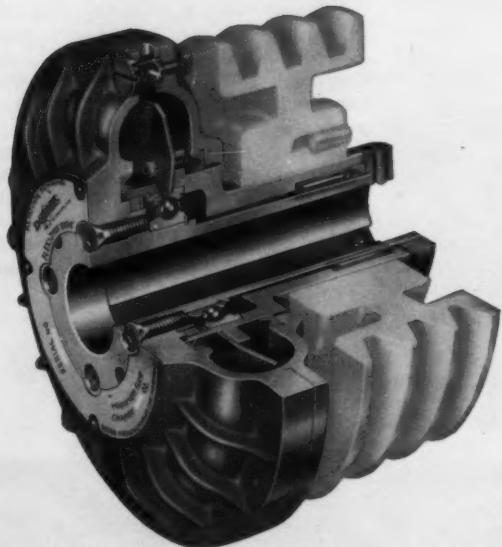
## FEDERAL-MOGUL

sleeve bearings  
bushings-spacers  
thrust washers

DIVISION OF  
FEDERAL-MOGUL-BOWER  
BEARINGS, INC.

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## WHAT'S YOUR PROBLEM?...



### HOW FLEXIDYNE WORKS

The "dry fluid" in Flexidyne is tiny heat-treated steel shot. A measured amount, called the "flow charge," is contained in the housing, which is keyed to the motor shaft. Inside the housing is a rotor, free to revolve relative to the housing, but connected to the load.

When the motor is started, centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor, which transmits power to the load. Initial slippage is momentary. Housing and rotor become locked together and achieve full load speed without slip and at 100% efficiency.

**CALL THE TRANSMISSIONEER**—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneers" in the white pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

28

Circle 28 on Reader-Service Card for more information



**DODGE**  
of Mishawaka, Ind.

- Overheated motors?
- Excessive belt maintenance?
- Breakage of materials being processed  
—like thread, wire, paper?
- Expense of oversize or high torque motors?
- High demand rate?
- Expense of reduced voltage starters?
- Clutch trouble?
- Breakage of transmission parts due to instantaneous shock loads?
- Damage and recurring down-time from overloads?

## FLEXIDYNE

THE DRY FLUID DRIVE

It is no longer necessary to accept the destructiveness—the costliness—of conventional starting in the mechanical transmission of power. Flexidyne changes that!

Flexidyne is the new way to start loads *smoothly*—to protect against shock and overload—to save power—all *without any sacrifice of efficiency at full load!*

This revolutionary development is ushering in "the day of the soft start"—which can mean thousands of dollars to you in equipment savings and in better, more economical operation.

Flexidyne is available, off the shelf, in Drives and Couplings. Capacities range from fractional to 1,000 hp. Ask your local Dodge Distributor or write us for technical bulletin.

DODGE MANUFACTURING CORPORATION, 300 Union St., Mishawaka, Ind.

### IDEAS...

#### MECHANICAL DEVICES

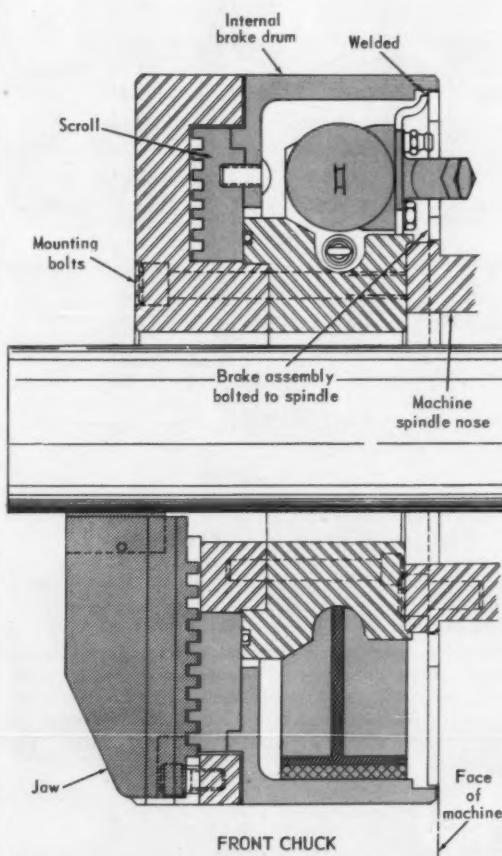
## Spindle-Powered Chuck

Victor W. Wigotsky, Eastern Editor

A new power chuck eliminates need for an external power wrench. Instead, power of the spindle is used to open and close the chuck.

The three-jaw spindle-powered unit employs an expanding automotive-type brake assembly which is attached to the headstock of the machine. An internal brake drum, fixed to the scroll of the chuck, is acted on by the brake. The chuck is then operated by stepping on a pedal which actuates a master cylinder and applies braking force to the drum. This stops the scroll and, depending on spindle rotation, opens or closes the chuck.

Chuck operation thus differs from that of a manual chuck, where the scroll is rotated while



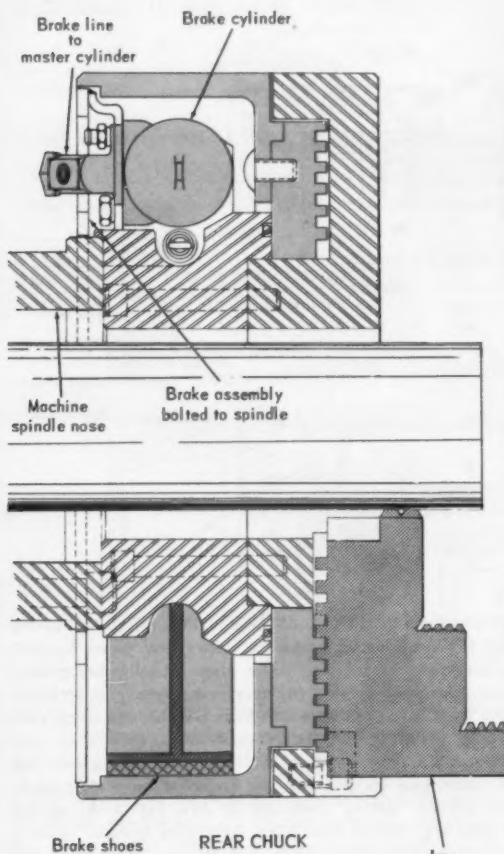
EXPANDING AUTOMOTIVE-TYPE BRAKE acts on internal brake drum attached to scroll. Stepping on pedal applies force to stop drum and attached scroll to open or

## Uses Automotive Brake

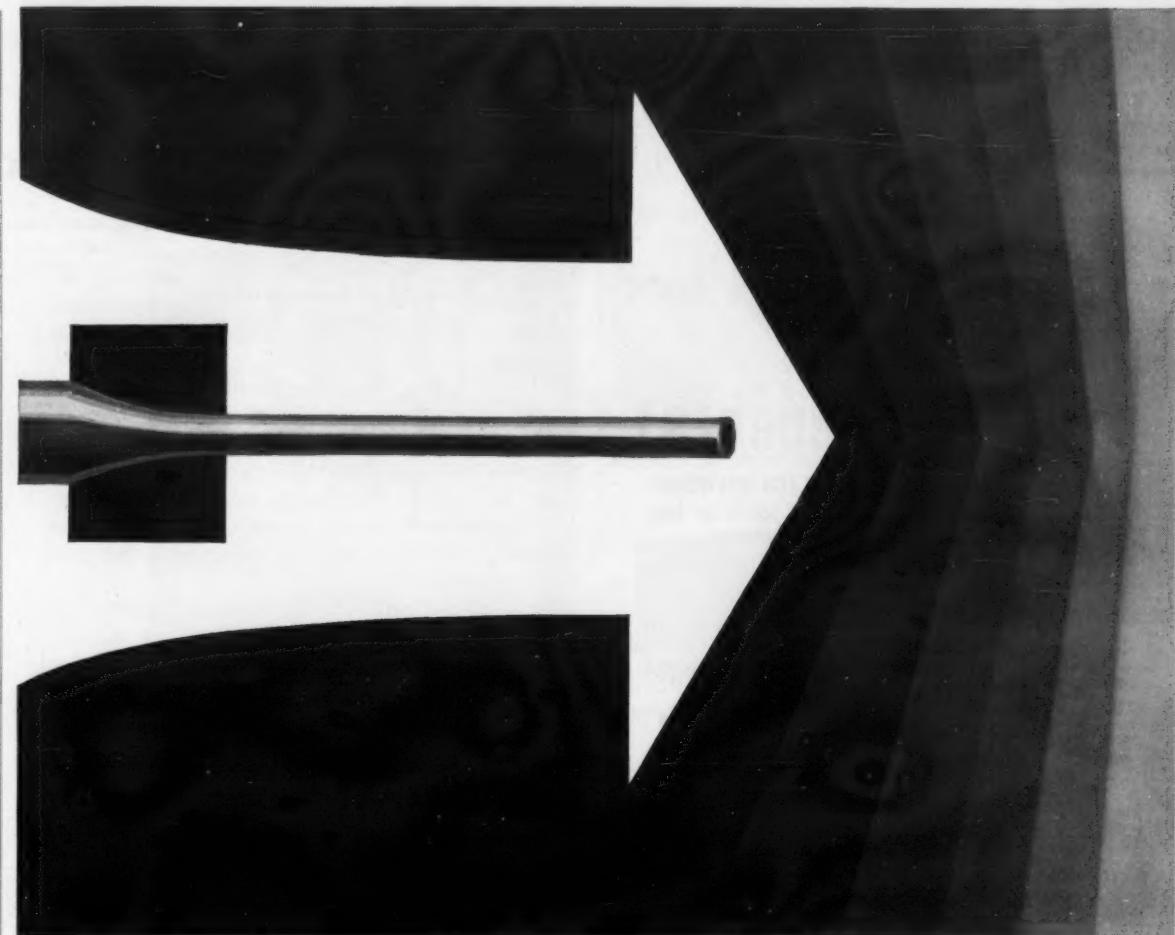
the body is stationary. In the new design, the body rotates to open or close the chuck while the scroll is held stationary by the brake mechanism.

The new chuck was developed for use on a pipe-threading machine which requires a chuck on each end of the spindle. The simple foot pedal control permits operation of both chucks from one position. Maximum gripping power of the chucks depends on the horsepower of the machine.

The new spindle-powered chuck was designed and manufactured by Union Manufacturing Co., New Britain, Conn.



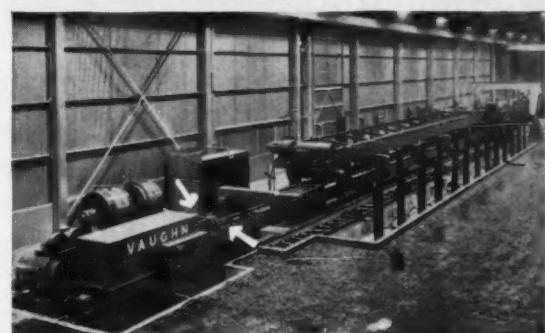
close chuck. Unit has size range equal to manual scroll chuck and also may have a large hole through center, making it suitable for bar or tubing work.



### How to shock-insure a \$250,000 tubing drawbench

*Firestone Airmount® impact protection saves drawbench-carriage damage and downtime*

Shortly after The Vaughn Machinery Company, Cuyahoga Falls, Ohio, installed a high speed dual chain drawbench for the Reynolds Metals Company, the limit switches failed to stop the carriage within the confines of the bench. It slammed into the drive section at full speed, about 550 fpm (with a kinetic energy of almost 1,500,000 pound-inches). Not only could this have caused many thousands of dollars of damage, but downtime would have been measured in months. Instead, damage was negligible, downtime almost non-existent. Why? Three Firestone Airmounts were stationed on the drive-head to gently absorb the impact. Valuable "insurance" indeed! And that's just one of thousands of profitable examples of how Airmounts are solving motion problems throughout industry. Whatever your equipment, if it produces damaging shock or vibration—or if it needs help for actuation—find out how much Airmounts can do for so little. Write to Dept. 42-1 for details, without obligation.



Here is the huge Vaughn dual chain drawbench at the Reynolds Metals plant in Phoenix, Arizona. Note Firestone Airmounts positioned at head of drive section, protecting against possible impact of carriage.

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# Firestone

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MECHANICAL DEVICES

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RUBBER 5 to 1! . . . Saves up to 500% in tire  
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## Automatic Terminal Capper Assemblies

E. J. Stefanides, Central States Editor

In a new machine for automatically assembling deposited-film type resistors, all assembly operations are performed on the surface of a continuously rotating drum.

This method of operation provides a simple mechanism which combines high production output, slow-speed machine operation and gentle parts handling. In addition, the simplicity of the design virtually eliminates misalignment and jamming of the work pieces and provides a machine which can be adapted readily to a variety of different length and diameter resistors.

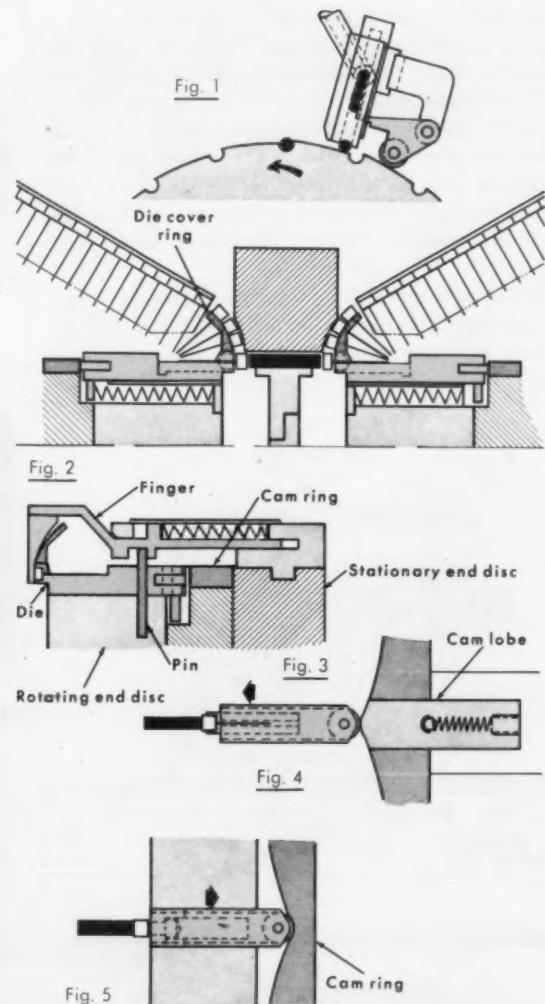
Some of the problems involved in assembly of these resistors arise from the delicacy of the deposited coating and the shatterability of the glass and porcelain bodies. Others arise from a need for accurate alignment as the octagonal, or circular, cross-section terminal caps are pressed on the end of the circular cross-section bodies.

In designing this machine it was decided that these problems could best be overcome by use of a non-indexing mechanism. The resulting design consists of a continuously rotating three-section (or disc) drum. The center section, or disc, has 20 open grooves about its periphery for picking up, holding and transporting bodies as fed from a stationary magazine. Each of the two outer discs is slotted about the periphery to carry 20 slotted, sliding, terminal cap dies. The outer discs also have a slotted die-cover ring arranged in front of the dies. These rings pick up the terminal caps as the body passes stationary terminal chutes, feed them into the dies and rotate them into a horizontal position.

A stationary seating mechanism operated by pins on the drums then seats the caps in the dies. As the dies carrying the seated caps pass stationary cam lobes fixed to the stationary end discs, these lobes force the die inward, capping the resistor body. Further along a depression in the cam ring allows the dies to retract to eject the completed resistor.

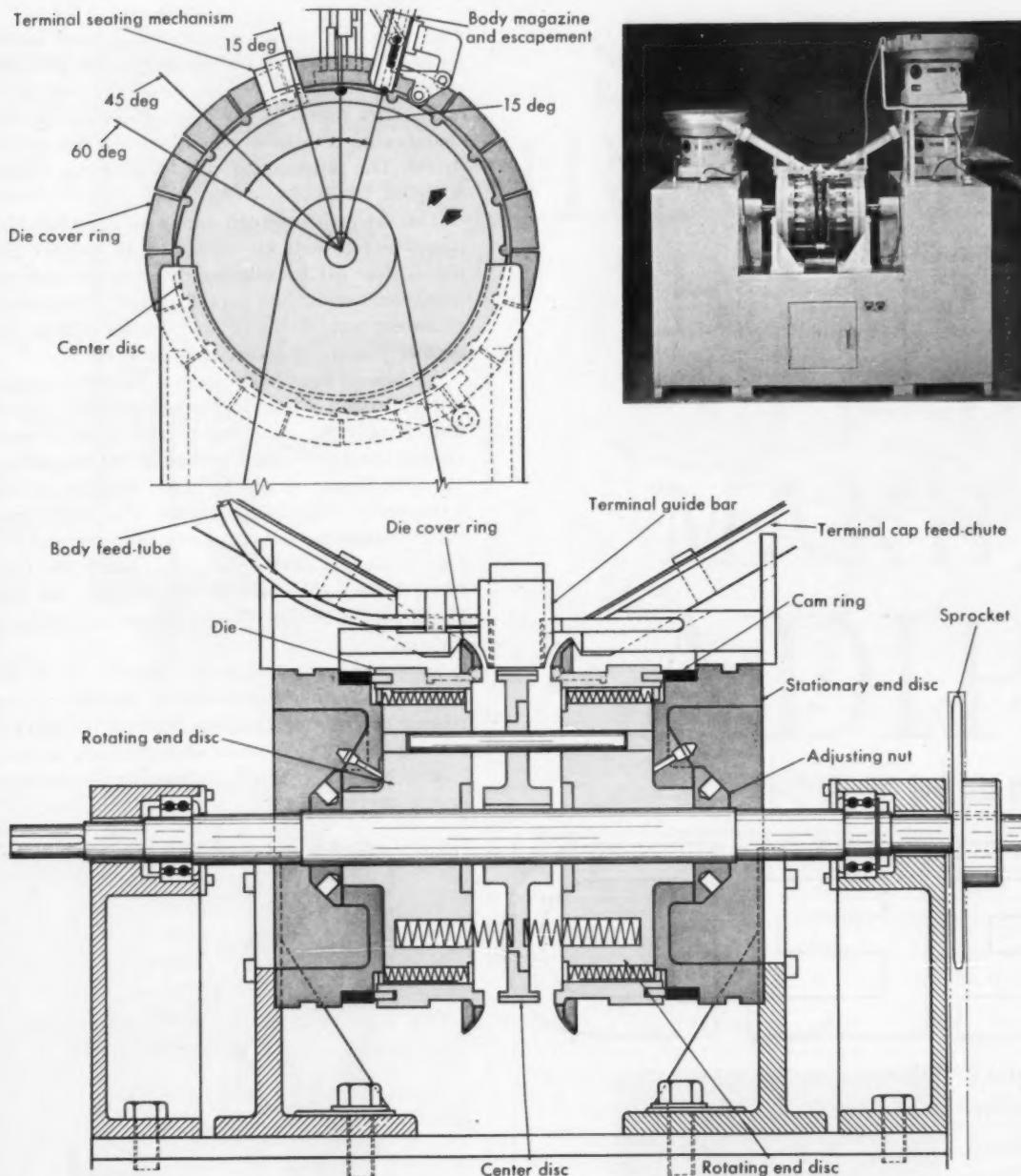
The whole operation is carried out automatically at a rate of from 9000 to 18,000 resistors an hour. The only manual requirement is that the hoppers which feed the body magazine and terminal cap chutes be kept full.

This machine is designed and manufactured by the Sigma Engineering Service, Inc., Custer City, Pa.



**SEQUENCE OF CAPPING OPERATIONS.** Fig. 1—At 15 deg before top dead-center, groove in center disc passes beneath body magazine. Escapement roller drops in following groove, releasing body. Fig. 2—As die cover ring slots pass terminal chutes, leads of bottommost terminals fall through cover slots and slots in top of dies. As terminals drop, they rotate into horizontal alignment with body. Fig. 3—At 15 deg past top dead-center, pins on die discs cam fingers of cap-setting mechanism inward, seating terminals in dies. Fig. 4—At 45 deg past top dead-center, cam lobes force dies inward, pressing terminals on resistor. Spring-loading prevents damage to machine if abnormal condition exists. Fig. 5—At 60 deg past top dead-center, depression in cam allows spring-loaded dies to retract. Ejector blades in bottom of die eject completed resistors.

## Resistors on Rotating Drum



**SECTION VIEW OF CAPPING MACHINE**—center disc is keyed and pinned to shaft. Two outer rotating discs are kept in register with center disc by pin; spring-loading of discs holds them against length adjustment nuts and stationary end discs. Length adjustments are made by loosening base mounting cap screws of stationary disc support brackets, then adjusting nuts. Spring force then positions both stationary and ro-

tating end discs. Stationary end discs carry ring cams which actuate capping and ejection movements of die and serve as mounting for stationary mechanisms. Drum assembly is chain-driven by variable-speed electric motor drive in base at speeds of 9 rpm to 18 rpm, slow enough to prevent damage and to keep bodies from being thrown out of open grooves.

## NEW PISTON PRESSURE SWITCH CONTROLS 2 INDEPENDENT ELECTRICAL CIRCUITS

Really TWO pressure switches for the price of ONE

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(Millions of cycles)  
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(in dirty fluid)

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##### LINKAGES & BEARINGS

WHICH WEAR QUICKLY  
(cause settings to drift  
and switch to fail).

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NO RETURN DRAIN PIPING  
(Sealed piston)  
MOUNTS WHERE CONVENIENT  
(Operates in any position,  
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(pistons get stuck).

PRESSURE SWITCH DIVISION



**b**arksdale valves

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IDEAS . . .

MECHANICAL DEVICES

## Poppet Dumps Accumulator Air

Edward W. Schrader, Western Editor

Each time the trigger is pulled in a hand staple gun, air is ported to a poppet piston. Air pressure operating on the larger area forces the poppet to open, thus dumping air from the accumulator chamber to a piston which moves the staple driver. The action is cycled each time the trigger is pulled.

The driver is returned automatically when the trigger is released. Air supply to the poppet piston is shut off by releasing the trigger and air contained behind the poppet piston is exhausted to atmosphere. Reduced air pressure behind the poppet piston allows the poppet to reseat.

Air behind the driver piston is vented to atmosphere through a hole in the center of the driver rod. Supply air now enters the annular area around the driver rod to return the driver piston.

As the driver returns, a small quantity of air is trapped in a damping cylinder. The small clearance between the OD of the return piston and the bore of the cylinder in the cap retards the flow of air leaving the chamber and cushions the end of the return stroke. This completes the cycle of the tool.

Staples are supplied to the driver end of the tool from a cartridge. A coiled tension spring passing over a pulley applies force on the staples, moving them into position each time one is used.

The Mark I Cyclamatic Portable Stapler is a design development of Calwire, Visalia, Calif.



PORTABLE STAPLE DRIVER weighs 5 1/4 lb and is capable of firing more than 300 fasteners per minute.



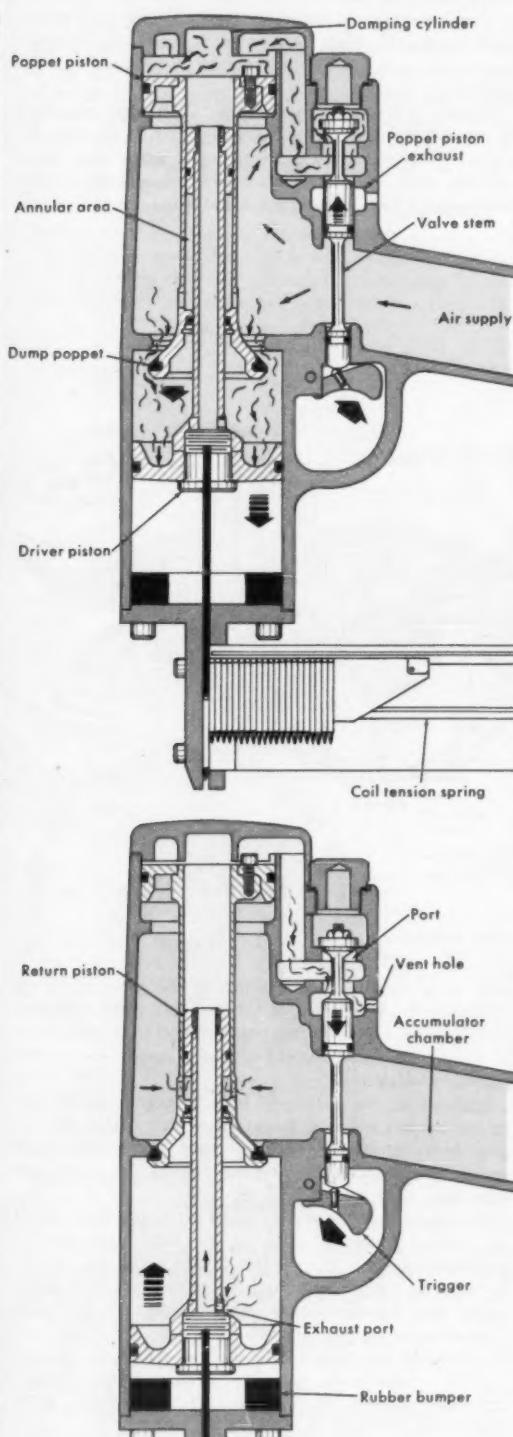
CHOBERT BLIND RIVETS SPEED ANCHOR NUT ASSEMBLY ON NAA T39 SABRELINER . . . With Chobert Blind Rivet System you can save money and time. One man, using the Chobert gun, can rivet four times as fast as two men using solid rivets on Anchor Nut Assembly. The Chobert Automatic Riveting Gun holds a mandrel of up to 92 rivets, and can be reloaded in 15 seconds. Start saving money and time . . . write now to Avdel, Inc., 210 South Victory Boulevard, Burbank, California.



AVDEL INC.

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to Drive Staple in Hand Gun



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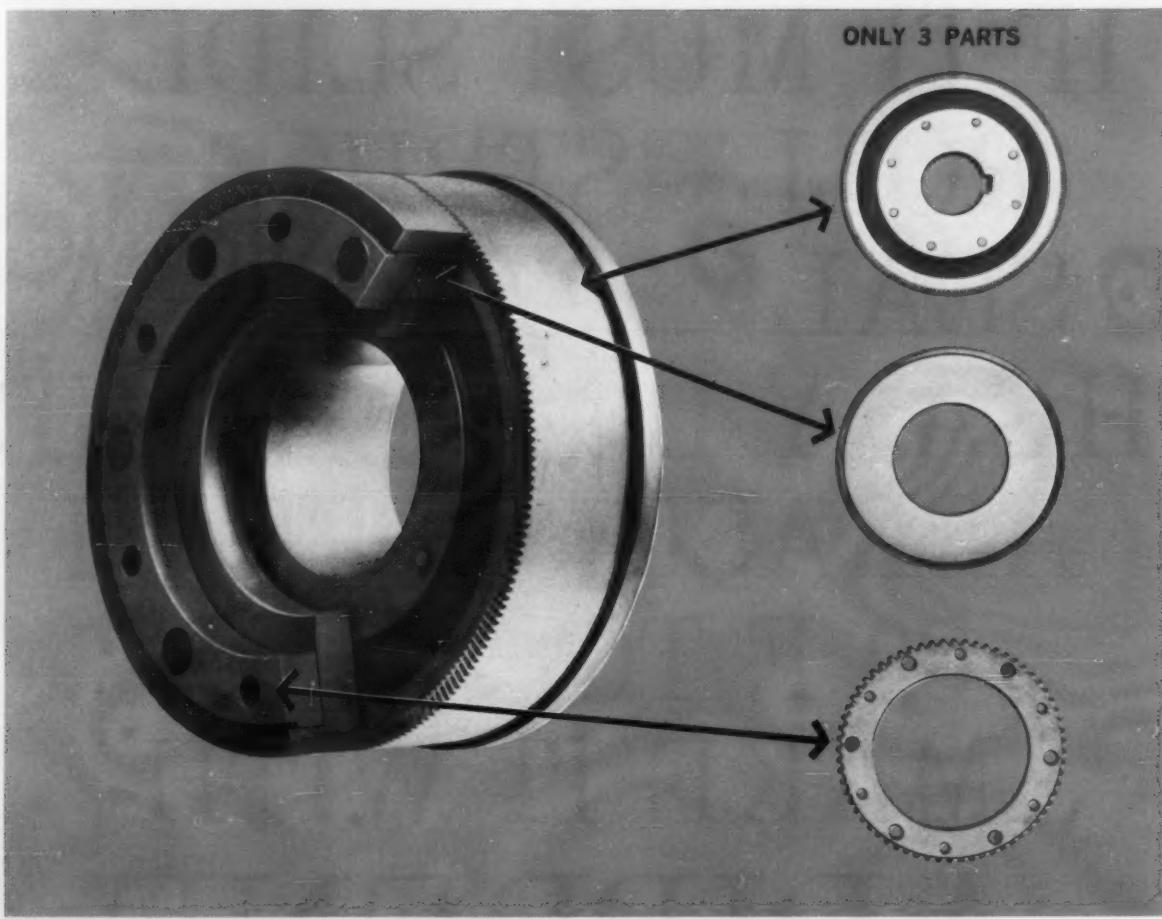
*Hardness, Shore A	88	95	97	99+
Hardness, Shore D	43	50	60	78
Modulus, 300%, psi	2100	3200	7000	-
**Tensile Strength at Break, psi	7000	8825	8500	8500
Elongation at Break, %	450	480	340	250
Izod Impact Notched ft.-lbs./in.	Flexed	Flexed	20	1.2
Split Tear, ASTM-D 470 lbs./linear inch	50	155	160	200
***Compression/Deflection, psi @ 5% defl.	575	750	1800	6000
Rebound Resilience, %	45	40	42	45
Oil Resistance	Excellent	Excellent	Excellent	Excellent
Low Temperature Brittle Point, °F.	Lower than -80	Lower than -80	Lower than -80	Lower than -80

\*Softer compounds ranging from 10 Shore A are also available. \*\*Samples pulled @ 1 in./minute (elastomer stocks normally pulled @ 20 in./min.) \*\*\*Shape Factor -1.0  
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*Simplified design means more dependable performance*

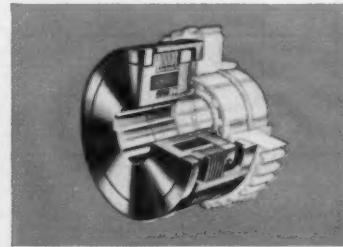
## BENDIX ELMAG (Electromagnetic) TOOTH CLUTCH

With only three parts, the Bendix® Elmag tooth clutch provides a simple, positive, compact clutch package for machine designers. The Elmag offers greater torque transmittal than other clutches of the same size. This means you can design for either greater machine capacity or space savings—or both.

For the end user, the Elmag offers the following dependable performance features. There is absolutely no idle torque—no connection between driving and driven members once disengaged. The Elmag can be disengaged under full load at any RPM, and engagement at relative speed is possible. The clutch's simple, bolt-on design makes it easy to mount; there are no additional splines or springs, no external disengagement

mechanism. Elmag tooth clutches are designed to perform in either wet or dry applications. They are available from stock in torque capacities ranging from 40 to 4,000 ft.-lbs.

**BENDIX ELMAG MULTIPLE DISC CLUTCH**—Ideal for stop-by-step acceleration of large masses. Disc stack is magnetically isolated. Wet or dry operation. Slip ring or stationary field design. Torque capacities: 10 to 16,000 ft.-lbs.



*For full details, write*

**Bendix-Elmira**

Eclipse Machine Division  
Elmira, New York



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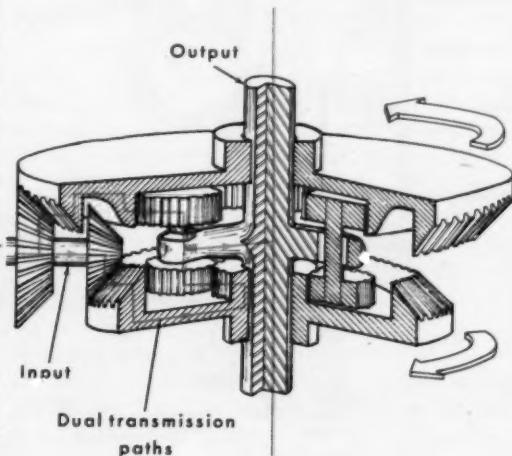
## IDEA MART

### AVAILABLE

#### **Subtracting Gear Reducer**

The principle of this reducer is that of dual gear paths delivering motion to a modified planetary gear which rotates the output shaft. Reduction is based on "subtraction" as compared with the function of "division" in the usual gear reducer.

Separate gears keyed to the input shaft turn two gears in parallel position about a common axis in opposite direction. Dual planetary gears (pairs of gears keyed to a common shaft) which may be of different diameter receive motion from both primary gears and deliver to the output



shaft at a reduction ratio which is the product of the difference in overall rpm of the two gear paths, modified by the simple reduction due to differences in the diameters of the input gears and the primary gears, and normal planetary reduction.

Evidence of the extremely high reduction which may be had by this system is found in the fact that if the two gear paths produced the same rpm, the output shaft would remain stationary; thus, near equal rpm would produce high reduction.

It appears that the system could be designed to almost any desired reduction ratio, at the same time offering minimum backlash, friction loss, weight and space requirements. The system lends itself to both heavy-duty application and miniaturization. Motion may also be taken from either of the primary gears at precise ratio reduction. For example, the final output shaft may turn the minute hand of a clock while one of the primaries turns the second hand. Write L. W. H., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.

## DESIRED

### New Product Ideas

As a manufacturer in a suburb of Chicago, we are certainly interested in new product ideas. I would be interested in some potential inventions or new products, or even talking with the parties concerned. I would appreciate your placing our name on your list; make use of our company name as someone who is interested in products and ideas.

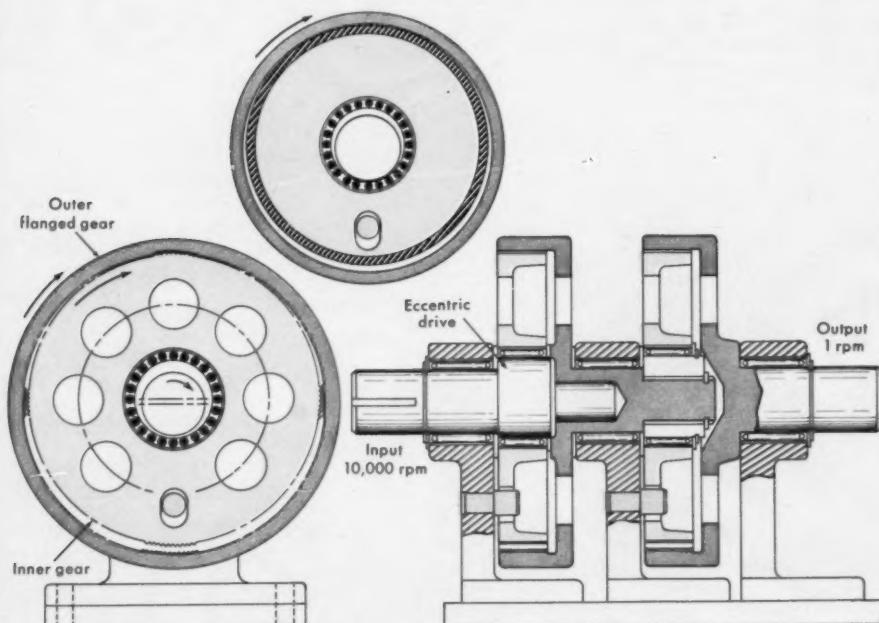
We are particularly related to the fastener field and are capable of doing any type of manufacturing in metal fabrication with the exception of cutting gears and plating. We have more than 200 screw machines and a large battery of

cold headers, boltmakers and hot upset equipment with related finishing equipment. A major portion of our work is for the agricultural implement and automotive companies and the manufacture of special fasteners, tappets, push rods, valve gear parts and special threaded products. We can do all heat treating and grinding work to close limits.

We would be interested in anything related in these fields of manufacture that can be made on our equipment. Write C-44, Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.

## AVAILABLE

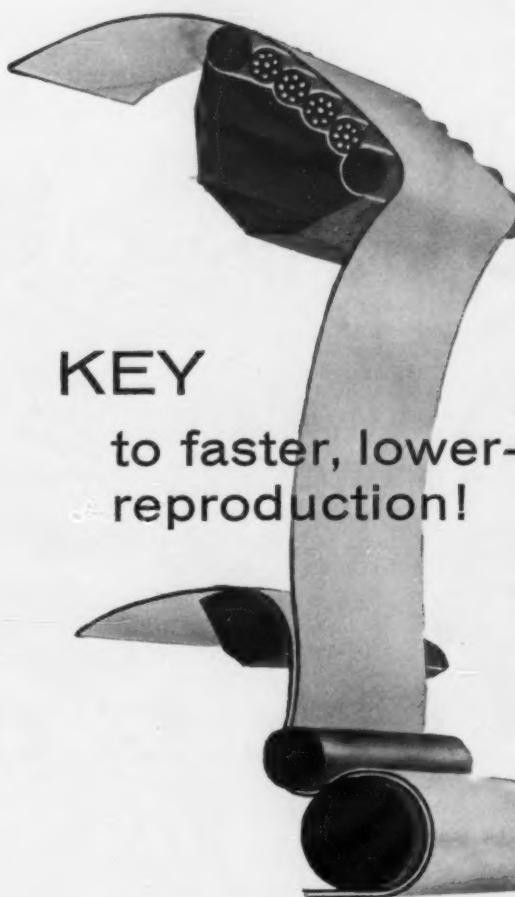
### Speed Reducer



This speed reducer consists of three essential parts: (1) the outer flanged gear with internal teeth, (2) the inner gear with external teeth and (3) the pin. With the eccentric in motion, inner gear does not rotate due to pin. However, in its oscillation through one turn of eccentric, inner gear moves outer gear through an arc of 5 teeth out of 500, or 0.01 of a revolution. Thus, the speed reduction is 100:1 and its accuracy is maintained by a fixed ratio of teeth.

With the dual or multiple arrangement shown much larger speed reduction is possible.

Using the same basic principle, this design has an inner wheel on which a band of rubber, leather or plastic material is bonded. Inner surface of gear may be serrated or knurled so that greater torque may be handled. Various dimensions for the eccentricity give various ratios of speed reduction so that very great ratios may be obtained due to smooth surface of band B. This cannot be done where teeth are involved but would be feasible with smooth synthetic rubber compound. Write W. E. G., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



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Heart of the Paragon-Revolute Star is its unique separation and development system — key reason why the Star will provide you more print production, per machine, per labor dollar.

The Star's air suction separation device is virtually infallible. At high speed, or any speed, the tracing and print are picked off the exposure cylinder by a unique air-knife and automatically separated by air suction.

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development in one pass, at any speed. A preheater tube prepares incoming ammonia for "demand" vaporization. Perforated stainless steel rollers allow virtually 100% exposure of sensitized sheets to the vapor. Prints travel a shorter route, come through clearer, faster, and there's  $\frac{1}{4}$  to  $\frac{1}{2}$  less ammonia consumption.

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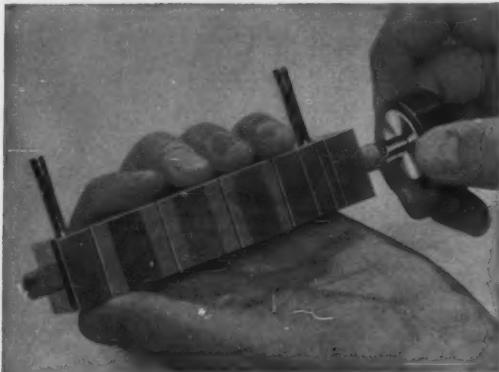
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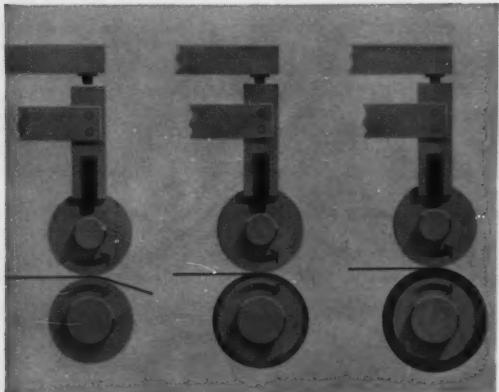
## PATENTS

# Practical Design Tips

No. 5 of a series

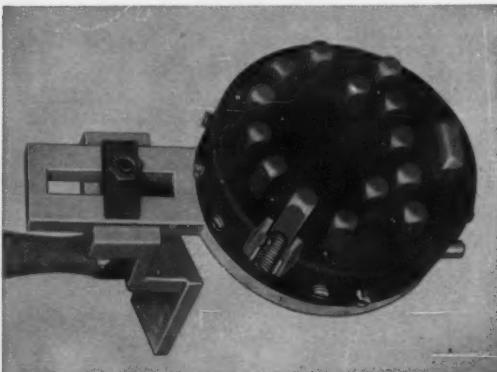


**TORQUE APPLIED TO ASSEMBLE PRECISION GAGE BLOCKS** is limited by this modified Vlier Torque Thumb Screw. Ground screw point mates with assembly screw; prevents overtightening with resultant damage to blocks. Torque Screws are available in four types, many thread sizes, lengths and end pressures.



**LIMIT SWITCHES ON THIS TEXTILE DRAWING FRAME ARE PROTECTED** by Vlier Spring Plungers. Bunching of broken threads causes rolls to lift, actuating limit switches which automatically shut off the machine. Plungers permit normal operation of the switches, but limit over-travel of switch actuating arm. Spring Plungers are available in four models, 50 sizes, various end pressures.

Cost conscious product designers are finding new uses for Vlier products in all types of original equipment. Simple applications such as shown below are saving hundreds of dollars. Examine your drawings and products today and see where these inexpensive, off-the-shelf parts can lower your costs.



**SPRING-LOADED BALL PLUNGERS HOLD MARKING STAMPS IN POSITION**, yet allow them to move freely when struck. Ball Plungers are threaded into metal inserts molded in rubber. Binding action of rubber prevents plungers backing off. Plungers come in six models; sizes from #4-48x3/16 to #5/8-11 x 1; 18 end pressures.



**FREE IDEA BOOKLET!** This informative 16-page booklet shows how other original equipment manufacturers are profiting from the use of standard Vlier parts. It may suggest ways you can save, so write for your copy today.

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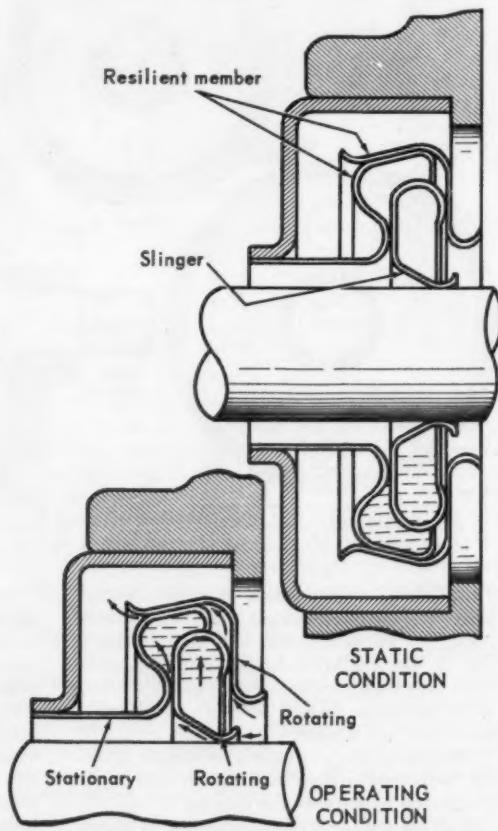
## Hydrodynamic Rotary Shaft Seal

U. S. Patent 2,960,356; Roland Tyce and Walter T. Czuba, assignors to Tyce Engineering Corp., Chula Vista, Calif.

This seal is useful in retaining oil around a rotating shaft which projects from the interior of an oil-containing machine housing.

The seal contains a rotating slinger driven hydraulically by a rotating shaft. The slinger operates between a pair of opposed resilient members which are deflectable by hydraulic pressure away from the slinging member. The resilient members overlap each other at the location surrounding the slinger. The resilient character of these members permits them to engage each other and opposite surfaces of the slinger member. This forms tightly engaged sealed surfaces about the shaft.

The hydrodynamic rotary shaft seal is particularly adapted for use in connection with high-speed machinery such as turbines, in which shafts may rotate at speeds up to 100,000 rpm.

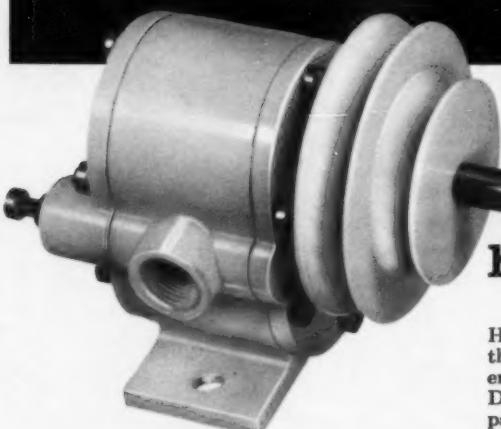
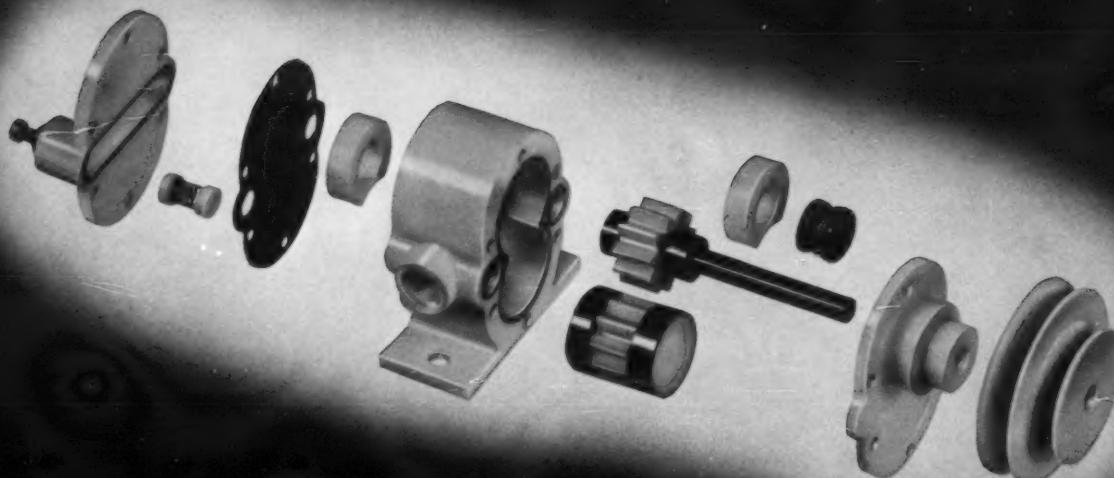


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working with  
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one of Du Pont's versatile  
engineering materials



## Pump parts of DELRIN® cut costs...reduce horsepower requirements

Here is a new gear pump that attains the maximum advantages of its patented design features by using DuPont DELRIN acetal resin for all the major parts (housing, gears, bearings, cover plates, bypass valve and drivesheave). Compared with rotary pumps now made in brass and other metals, the new pump of DELRIN has better efficiency, less heat buildup, improved bearing characteristics with no lubrication, quieter operation and longer life. The manufacturer reports that the low friction of DELRIN reduces horsepower requirements as much as 50% over comparable models in brass.

In addition, economical injection molding of these parts to close tolerances—plus the elimination of expensive finishing operations—provides the greatest possible savings in pump cost. The pump parts are molded by Artag Plastics Corporation and Chi-

cago Molded Products for Planet Products of Chicago, Illinois.

As in most applications, it is a combination of property advantages that makes DELRIN outstanding in performance. The different parts of the pump depend, in varying degrees, on such properties of DELRIN as: high strength, stiffness, creep resistance, corrosion resistance, non-lubricated bearing characteristics, low friction, dimensional stability, abrasion resistance and excellent fatigue life while subjected to a range of temperatures and environments.

On the following page, you'll find more examples of how these properties are being used to improve the performance and lower the production costs of a variety of pumps. The details may well stimulate your thinking about the advantages of DELRIN for your products.

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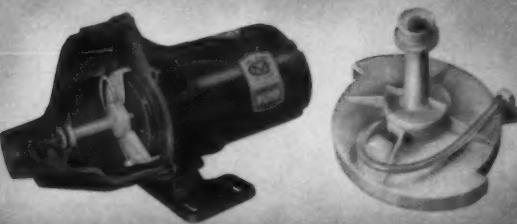
**Delrin®**

one of Du Pont's versatile  
engineering materials

## How parts of DELRIN® improve pump performance



**WALKER** lubricator uses DELRIN for the pumping unit of a new improved central lubricator for vehicles. Here the high temperature strength of DELRIN is a prime requirement—the pump body must withstand under-the-hood temperatures up to 250°F. Pump body, cap, check valve and tube connector are all economically injection-molded of DELRIN. They meet the exacting mechanical requirements for the pump in addition to providing major savings in manufacturing costs. (Molded by G. Felsenthal and Sons, Chicago, Illinois, for Walker Manufacturing Co., Racine, Wisconsin.)



**CLAYTON MARK** jet pump has an improved volute housing and venturi assembly of DELRIN, replacing the former combination of cast iron and brass, and offers significant advantages in both cost and pumping efficiency. Creep resistance, abrasion resistance and dimensional stability, even under elevated temperatures, are necessary here. The two parts of DELRIN are easily and economically joined by spin welding. (Molded by Chicago Molded Products, Chicago, Illinois, for Clayton Mark Company, Evanston, Illinois.)



**RED JACKET** "Trailblazer" jet pump uses new injection-molded impellers of DELRIN, because these parts give superior performance over comparable models in brass through increased efficiency, greater abrasion resistance, reduced mineral buildup and longer life. In addition, the use of DELRIN resulted in a 35% saving in impeller costs. (Molded by Chicago Molded Products, Chicago, Illinois, for Red Jacket Manufacturing Company, Davenport, Iowa.)

These are only a few examples, selected from one particular field, of the many ways in which DELRIN is improving designs and effecting economies in hundreds of applications across a broad range of industries. Why not translate the cost and performance advantages of DELRIN acetal resin in terms of your product? Mail the coupon below for further information.

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# FASTENOMICS

TIPS ON FASTENER APPLICATIONS BY STANSCREW

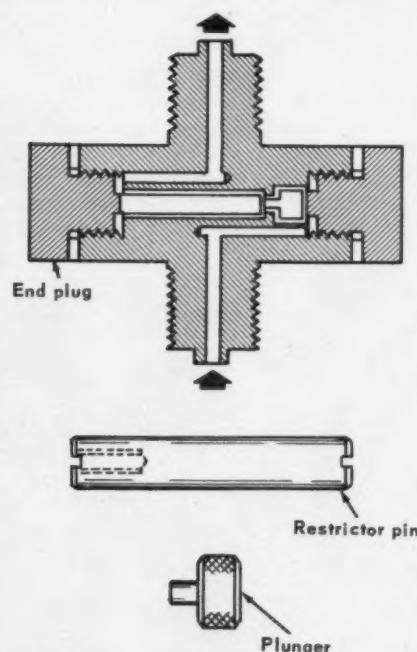
## Pulsation Damper

British Patent 833,121; Frederick A. Briston, Barnet Instruments, Ltd., Bath Place, Barnet, Hertfordshire, England.

A cylindrical plunger-type valve in this pulsation damper is seated automatically by hydraulic pressure to permit removal of restrictor pin without fluid loss. The replaceable restrictor itself is an end-slotted cylindrical pin of diameter slightly less than the bore in which it is mounted.

In operation, the pressure fluid flows from the inlet past the valve which is held off its seat by the inner end of the pin, then through the bore clearance. The restriction thus offered to free flow damps out pressure fluctuations and pulsations.

Damping efficiency depends on the fluid pressure and working viscosity. Thus, correct size pin must be determined experimentally. During replacement of the restrictor pin, unscrewing the end plug causes the valve to move on to its seat under pressure of fluid. Consequently, the restrictor can be removed without loss of fluid from supply line.



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## Bright or Heat-Treated Hex Cap Screws?

### Each can save you money

Bright and heat-treated hex cap screws (SAE Grade 5) are produced to the same dimensional specifications. Heat-treating, which results in a somewhat higher cost, gives superior hardness. The greatest difference is the higher tensile strength, as shown below.

#### HOW TENSILE STRENGTH COMPARES

Diameter Coarse Thread (UNC)	Bright Cap Screws Tensile Strength (Pounds)	Heat-Treated Cap Screws Tensile Strength (Pounds)
1/4"	2,200	3,800
5/16"	3,600	6,300
3/8"	5,350	9,300
1/2"	9,800	17,050
5/8"	14,450	27,100
3/4"	21,400	40,100

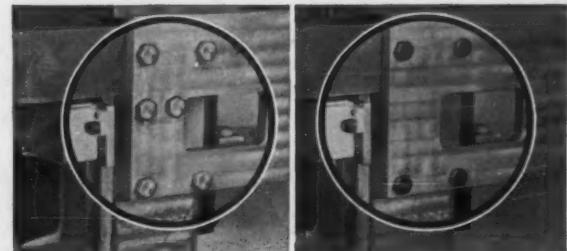
#### Pick The Right One

Selecting the right cap screw can mean substantial savings. For example, in the support plate assembly at right, six  $\frac{3}{8}$ " bright cap screws were used. Investigation showed four  $\frac{5}{16}$ " heat-treated cap screws could do the job more efficiently. By eliminating two fasteners and substituting a smaller size, total fastener costs were cut 37% . . . and important additional savings were made by reducing machining and assembly time.

The best answer for any application can be determined only after careful consideration of the advantages and disadvantages of both fasteners.

#### Bright Hex Cap Screw Advantages

1. In pure fatigue (no pre-stress on the fastener) the difference in fatigue strength between a bright and a heat-treated cap screw is not sufficient to offset the cost difference.
2. When bolting low strength materials, high clamping forces can cause the material under the bolt head to indent. Here the higher clamping force of the heat-treated screw offers no advantage.



Fastener costs were cut 37% when heat-treated cap screws were substituted for "brights" in this support plate.

3. In applications where joint rigidity requires a certain minimum number of fasteners, "brights" usually are the economical answer.
4. Greater availability from local sources simplifies field maintenance.

#### Heat-Treated Hex Cap Screw Advantages

1. In a rigid joint you get far more clamping force per dollar cost.
2. The shear strength per dollar cost is substantially higher.
3. When heads are exposed to abrasive conditions, heat-treated screws will sustain considerably less damage or wear.

#### Hold Inventories Down

Obviously, the best and cheapest screw for each job varies with the application. Unless you use a very large quantity of each grade, however, it is seldom wise to stock two grades of the same size and type of fastener, since this raises inventory costs. Normally the simplest and cheapest approach is to stock the stronger . . . or heat-treated . . . variety.

#### For Further Information

Our fastener specialists will be happy to give you further information or suggestions on specific applications. You can get in touch with them through your local Stanscrew distributor. He'll also be happy to supply you with any of Stanscrew's 5,500 different types and sizes of standard fasteners.

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HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT

WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY

2701 Washington Boulevard, Bellwood, Illinois

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## ONE-PIECE SELF-RETAINING FASTENERS \*

### \* plastic

Plastic fasteners are excellent where corrosion resistance is important. Near perfect insulators, they are ideal for electrical assemblies and for wire retaining straps. Fasteners can be furnished in nylon, polystyrene, polypropylene, etc.



### \* metal

FERROUS AND NON-FERROUS

Any reasonably ductile metal can be used for many Robin fasteners—sheet metal assembly clips, wire and tubing retainers and moulding or ornament clips. Various materials can be chosen for tensile strength, corrosion resistance, shear strength, etc.

### \* spring-steel

Many fastening jobs can best be handled by spring tension fasteners. Example shown at right is a blind trim moulding clip that is applied from front side of panel.

(\*PATENTED & PATS. PENDING)



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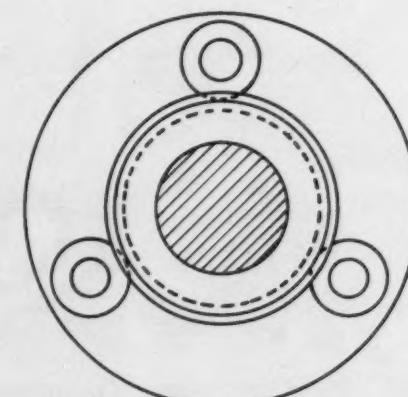
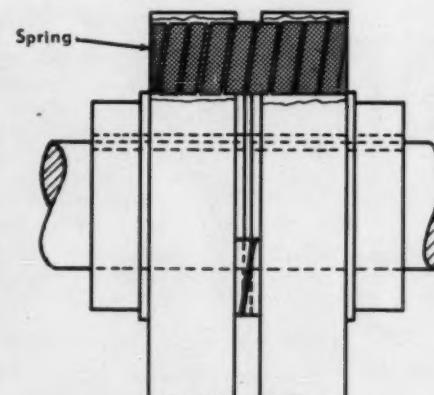
### PATENTS...

#### Coupling

U. S. Patent 2,959,944; Raymond G. Brownstein, Ellwood City, Pa., assignor to The Automatic Mfg. Co., East Pittsburgh, Pa.

A free alignment coupling connects driving and driven shafts which are spaced from each other and disposed in approximate alignment. The coupling comprises a pair of identical hubs, one of which is affixed to each of the shafts. A portion of each hub is enlarged. The enlarged portions are positioned in face-to-face relationship but spaced from each other. Several holes are drilled in each of the enlarged portions. Helical springs are positioned in the holes in one of the hubs and extend across the space between the hubs and into the holes in the other hub. The springs are retained in the hole in any desirable manner, for example, by split retaining rings.

The coupling is simple to assemble and disassemble, requires no special tools and is easy to lubricate. It has few parts sliding relative to each other to cause wear of the surfaces of the coupling.



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YOU LEAP..**



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### Rotary Compressor

French Patent 1,217,928; P. August and E. Klesatschke, Paris, France.

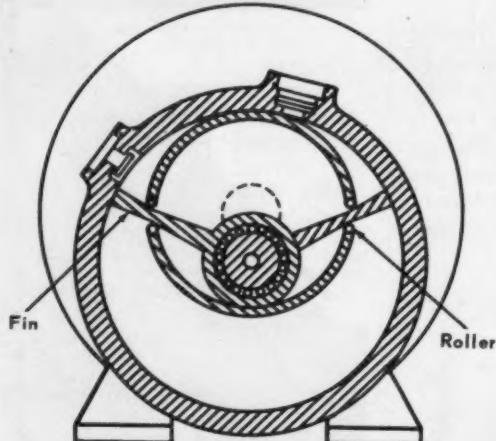


Fig. 1

The use of rollers between fins and offset rotor is claimed to reduce friction, wear and leakage in this rotary compressor design. Whether the rotor is the driving part (Fig. 1) or the fins drive the pump or compressor (Fig. 2), the rollers are used to provide adequate rolling action.

The rollers can be of small diameter as in Fig. 1. In this case, fin surfaces have very small curvature. If larger rollers are used, as in Fig. 2, a larger curvature must be provided on the fin surfaces to avoid friction.

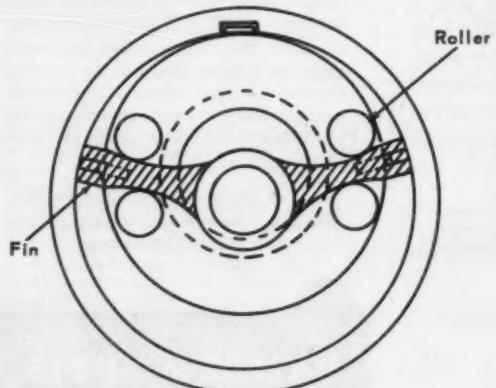


Fig. 2

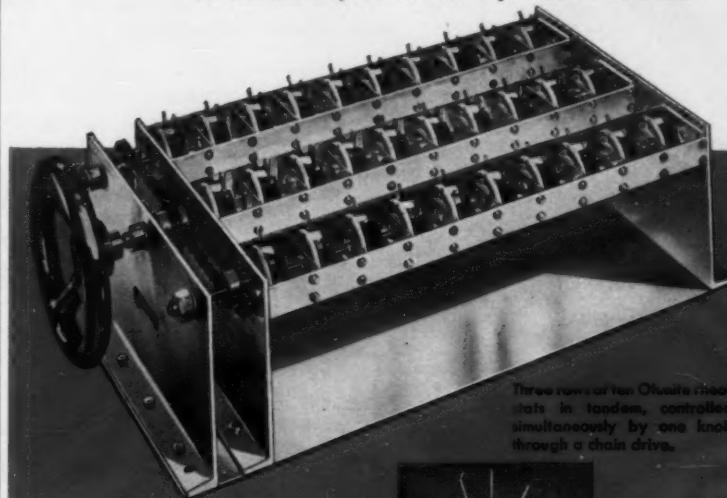
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Two groups of four Ohmite taper-wound rheostats mounted in tandem, controlled by a single knob through a chain drive.

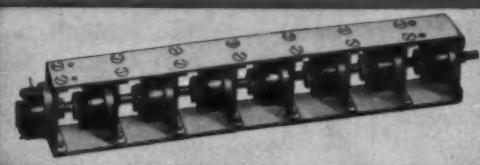


Three rows of ten Ohmite rheostats in tandem, controlled simultaneously by one knob through a chain drive.

Ohmite rheostats can be mounted with two, three, or more in tandem for operation by one knob. Controls several circuits simultaneously. Model H and miniature Model E rheostats in tandem save panel space.



Example of a 360° rotation rheostat with a wire lead tapped winding.



Rheostat with tapped winding and sensitive switch, arranged to operate at any preselected position of contact arm.



Typical Ohmite motor-driven tandem-rheostat assembly.



Ventilated cage prevents mechanical injury, or human contact with electrically "live" parts.

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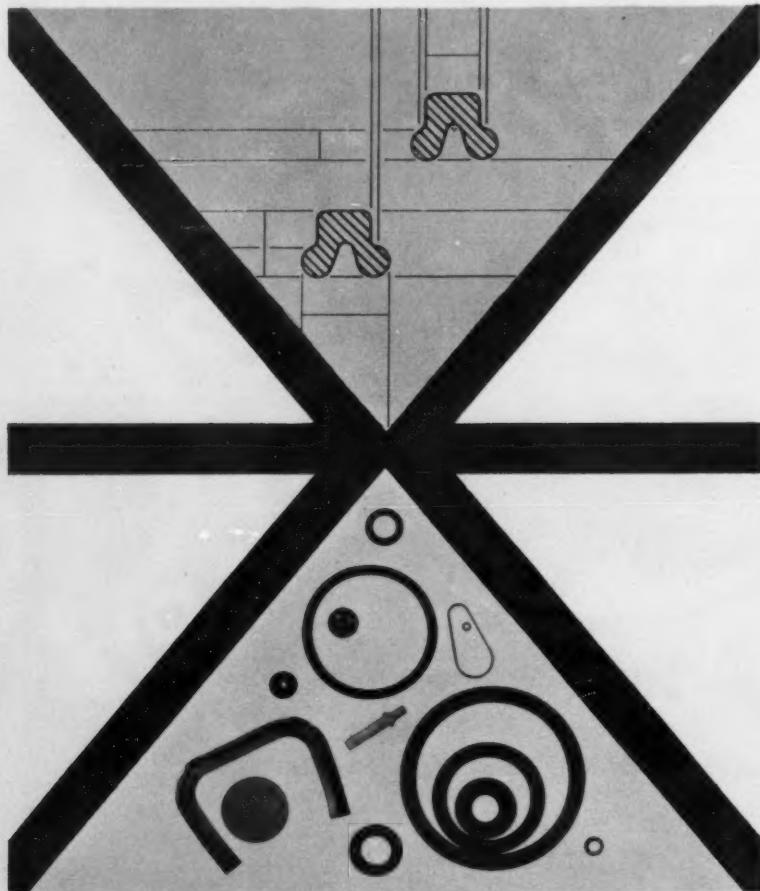
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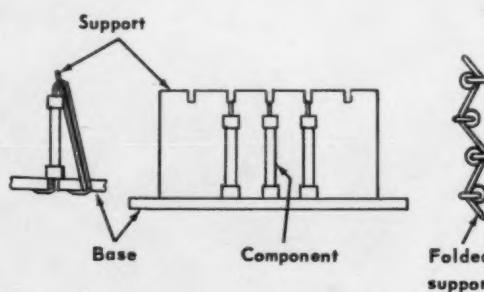
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## PATENTS...

### Component Mounting

Dutch Patent 231,386; N. V. Philips Gloeilampenfabrieken, Eindhoven, Holland.

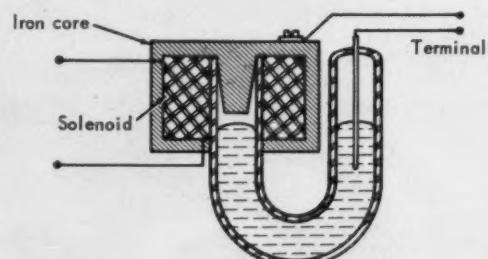
This simple component mounting system is suitable for high-density configurations on printed circuit boards. Components are held normal to the board, with one lead passed through a hole, bent, clipped off and soldered. The other lead is passed through a notch on top of an obliquely located, insulating, flat support plate, then runs down the width of this plate into another hole in the base board. The second lead is then also bent over, clipped and soldered.



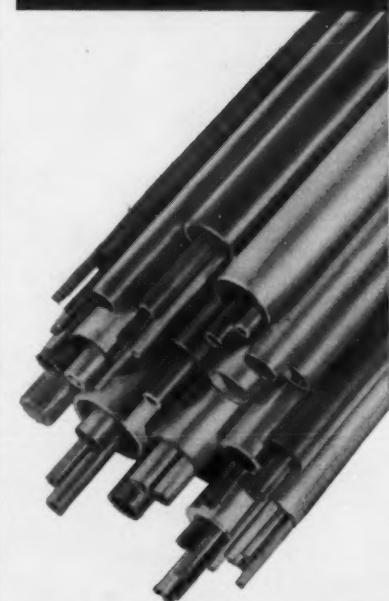
### Magnetically Actuated Relay

British Patent 831,155; Curt Kohlstrom, Polhemsgatan 13c, Sandviken, Sweden.

This simple relay uses a liquid mercury-ferromagnetic alloy which moves when subjected to a magnetic field. An evacuated or inert-gas-filled U-tube containing the liquid alloy has one branch end surrounded by a solenoid coil. The coil is surrounded by an E-shaped iron core. When current is applied to the coil, the liquid alloy is attracted to the iron core middle leg. Relay contact action then occurs between the terminals on the core and on an electrode partially submerged in the second U-tube branch.



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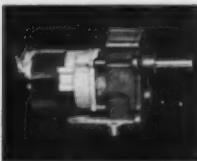


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DESIGN NEWS—JANUARY 16, 1961

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

### CONSTANT-SPEED ACCESSORY DRIVE

U.S. Patent 2,963,866; Charles C. Bookout and Paul E. Taylor, assignors to Ford Motor Co., Dearborn, Mich.

### TORSIONAL VIBRATION PICKUP DEVICES

U.S. Patent 2,963,902; Hans Baumgartner, assignor to Schweizerische Lokomotiv- und Maschinenfabrik, Winterthur, Switzerland.

### PRESSURE REGULATOR

U.S. Patent 2,963,977; Frederick E. Smith, assignor to Thompson Ramo Wooldridge Inc.

### ELECTRO-HYDRAULIC SERVO VALVE

U.S. Patent 2,964,018; John R. Farron, assignor to The Bendix Corp.

### FLOW FORCE COMPENSATED VALVE

U.S. Patent 2,964,023; John W. Meulendyk, assignor to Pneumo Dynamics Corp., Cleveland, Ohio.

### PILOT VALVE

U.S. Patent 2,964,057; Ernest F. Dyson, assignor to The Bristol Co., Waterbury, Conn.

### PRESSURE-FLOW SERVO VALVE

U.S. Patent 2,964,059; Lewis H. Geyer, assignor to Moog Valve Co., Inc., East Aurora, N. Y.

### Brake Mechanism

U.S. Patent 2,964,135; Darrel R. Sand, assignor to General Motors Corp., Detroit, Mich.

### HYDRAULIC BRAKE LOCKING DEVICE

U.S. Patent 2,964,141; John J. Schlumbrecht, Three Rivers, Mich.

### SPRING ASSEMBLY FOR RELIEF VALVES

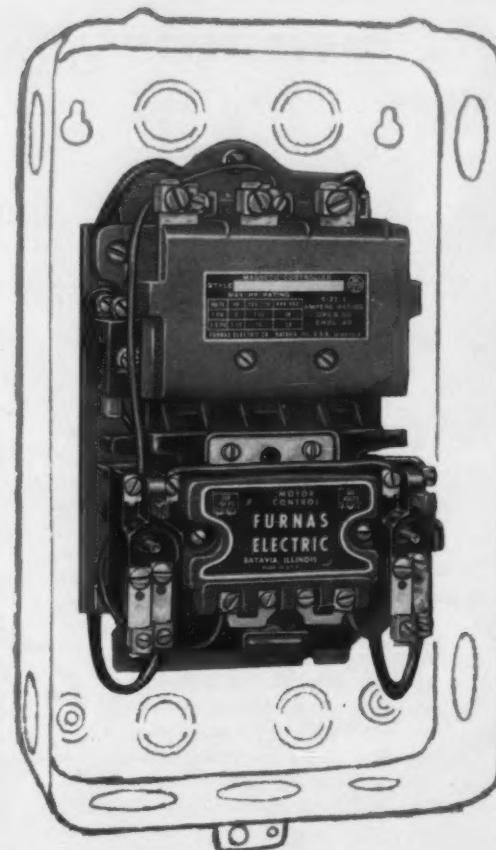
U.S. Patent 2,964,310; Paul H. Stahlhuth, assignor to Sundstrand Corp.

### ROTARY CONDUIT SEAL

U.S. Patent 2,964,340; Ora A. Kinzie and Hubert J. Watts, assignors to Continental Oil Co., Ponca City, Okla.

### GASKET ASSEMBLY

U.S. Patent 2,964,343; Karl A. Klingler, Naperville, Ill.



## NEW SIZES 2 and 2½ FURNAS MAGNETIC STARTERS

Take advantage of the new design of Furnas Size 2 and Exclusive Size 2½ Starters. Rated through 30 hp, 440 volts, the Size 2½ fills many applications normally requiring a much larger Size 3 Starter. Available for two, three or four pole applications, these units feature low wattage magnet, dual voltage encapsulated coils, silver-cadmium oxide contacts, and identical mounting area for both sizes. All components are front removable. You get better performance and longer life, plus unmatched economy.

Write today for Bulletin 14-B2—1078 McKee St., Batavia, Illinois

A93



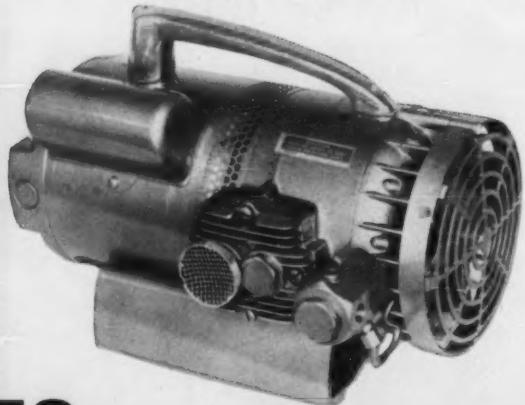
## FURNAS ELECTRIC COMPANY

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30 gallon Air Tank  
Motor Compressor Outlets



Gasoline Engine Driven  
Compressor Outlets

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**AIR COMPRESSORS**  
BELL & GOSSETT COMPANY  
Dept. GM-18, Morton Grove, Illinois

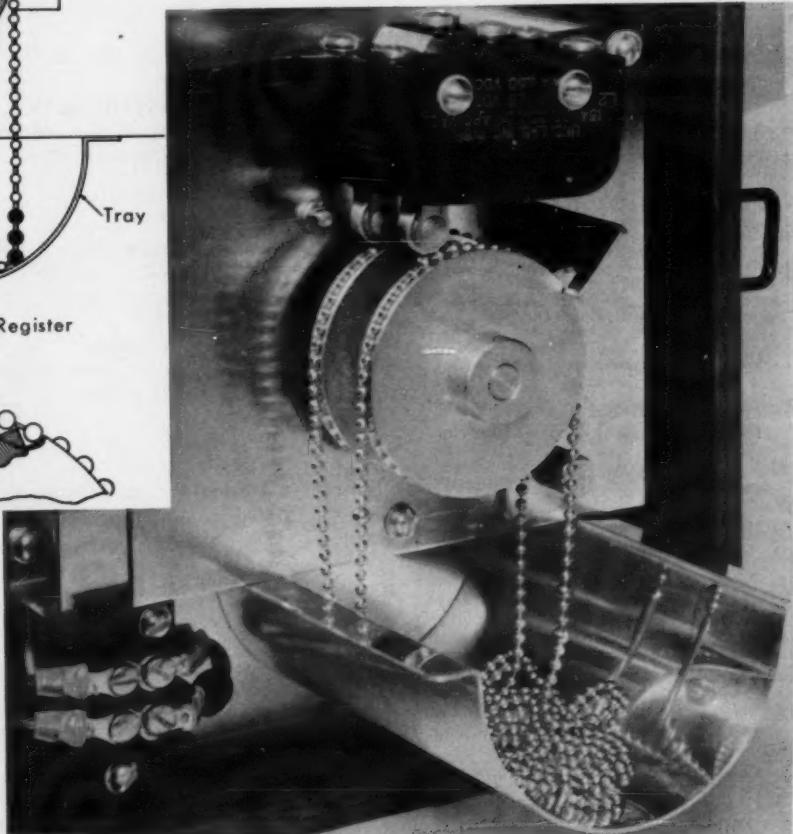
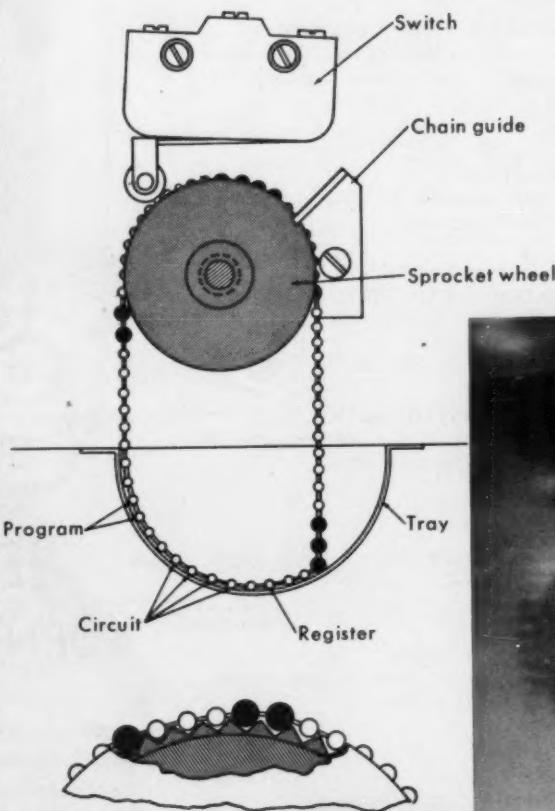
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DESIGN  
IDEAS  
NEWS

ELECTRICAL DEVICES

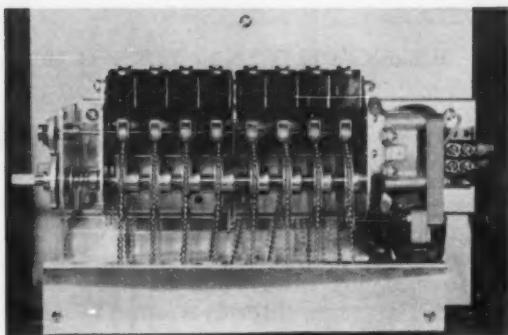
## Bead Chain Timer Replaces Tape for Sequence Control

Lars G. Soderholm, Midwest Editor



STAINLESS STEEL CHAIN has brass bead to provide register at start; another set of brass beads indicates particular circuit of chain by number; third set of beads indicates program. Timer uses special sprocket wheel with indentations, large beads project high enough above indentation to trip switch.

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MULTIPLE CIRCUITS in bead chain timer are possible by arranging sprocket wheels on common shaft. Sprocket shaft is held by spring-loaded retainer to permit rapid removal and replacement of sprocket and chains when new program is desired.

A new bead chain timer uses an endless chain in which oversize beads actuate a miniature switch as they pass over the driving sprocket. Standard timers have up to 12 switches, all operated from the same sprocket shaft to permit synchronized multiple switch operation.

The bead chain timer is a solution to a problem that required tape sequence control but could not justify its high cost. It uses a number of switches, each controlling a separate circuit.

The bead chain timer can be operated in two ways. In applications where synchronization can be timed, a synchronous motor turns the common sprocket shaft through a gear train. A single large bead or succession of large beads holds the switch in either open or closed position until all the beads pass through.

In applications where sequencing is controlled by the completion of the preceding operation, a rotary solenoid can be used to advance the bead chain in the timer. With this arrangement a sensing device sends an electrical pulse that turns the sprocket shaft through some preset angle.

Larger beads are covers that are crimped over the standard small beads. During the placing of the covers, the chain becomes stretched slightly which provides flexibility for the large beads to pass around the sprocket.

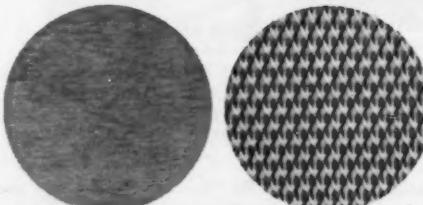
Although the bead chain can be made in nearly any length, long timing periods within which short closures are required can be obtained most easily by using two chains. One of the two is made with an extra bead of length and the mating switches are connected in series. With this arrangement, the chains continue to turn until two large beads come into alignment and trip both switches before the circuit is closed. Accuracy is a function of speed and chain length, and can be  $\pm \frac{1}{3}$  bead.

Patent is pending on the bead chain timer made by the Eagle Signal Co., Moline, Ill.

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## If you made aluminum crust for apple pie which would be best to use?



**PLAIN OR PATTERNED?** To help you decide, send for free sample kit of Fairmont embossed pattern sheets now putting new sales appeal into everything from awnings to truck bodies. Fairmont offers truly wide range of alloys, tempers, gauges, finishes. Write Dept. 29A, Fairmont Aluminum Company, Fairmont, West Virginia.

THE RIGHT ANSWER TO ALUMINUM BUYING PROBLEMS depends upon right materials utilization.

For instance—many an item slated for plain sheet (because this seems to be most economical) can really be fabricated on a more practical level with one of Fairmont's embossed patterns. A lighter gauge embossed material provides dimensional stability, increases yield on a cost-per-pound basis, improves product eye-appeal.

MORAL: before final buying decisions are made, consult with a Fairmont field engineer. His mature and varied experience among aluminum fabricators makes him a whiz at application ideas that help you buy profitably. And he's backed by the aluminum source, according to a recent survey, that rates first for fulfilling promises and commitments.

**FAIRMONT ALUMINUM COMPANY**

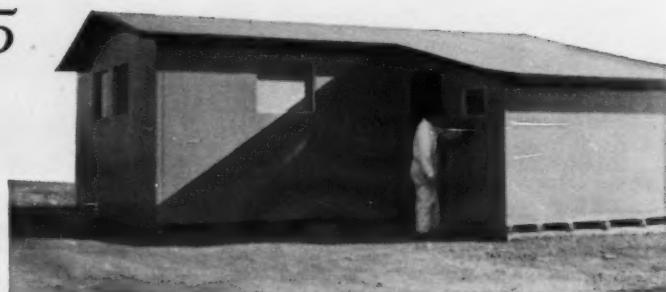
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# how to build a house in a day...



**1** Floor panels are locked to joists laid on permafrost ground.

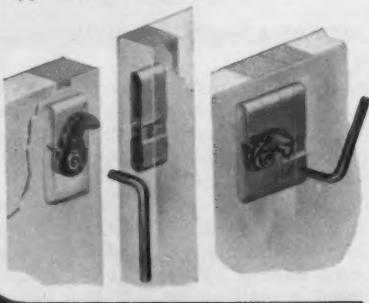
**2** Doorway is first wall panel to go up. It locks to floor.

**3** Walls and partitions lock to floor and to each other.

**4** Roof panels go on last. This takes about three hours.

**5** Complete in 7 hours! Floor, walls, roof panels—It's all done with Simmons Dual-Lock fasteners.

Standard Dual-Lock withstands 2500-lb. tension; may be modified for high-load applications to 4500 lbs.



- This house is put up in a day—and can be taken down in half a day!
- Key to quick assembly-disassembly is the Simmons Dual-Lock.

Dual-Lock is a high-load, positive-locking structural fastener perfectly adapted to panel fastening of demountable shelters, shipping containers, covers, cowlings... and to all butt-joint fastening jobs. It can be recess-mounted as in the application pictured, or surface-mounted on sheets or panels. Locks with heavy closing pressure, with very light pressure required on the key.

Arctic Units, Ltd., Toronto, Canada, is putting up 90 "Eskimo Houses" on the DEW Line. Panels, including roof, are plywood-covered styrofoam designed for insulation against Arctic cold.

WRITE FOR CATALOG 760. Complete details of Dual-Lock and other dependable quick-operating Simmons Fasteners with unlimited money-saving applications.

■ Samples and engineering service available upon request.

## SIMMONS FASTENER CORPORATION

1762 North Broadway, Albany 1, New York

INK-LOCK • HINGE-LOCK • HOOK-LOCK • SPRING-LOCK • CAM-BOLT • DUAL-LOCK • QUICK-LOCK • ROTO-LOCK

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## IDEAS...

### ELECTRICAL DEVICES

#### High Frequency Increases

Edward W. Schrader, Western Editor

As the operating frequency of fluorescent lamps is increased, the efficiency of the lamp is increased. The gain in efficiency is caused by the reduction in lamp end losses and improved efficiency of the light column. Lamps operating at 60 cycles have a cathode drop of 10-15v and an anode drop of 3-6v. Operation at high frequency materially reduces these losses.

The largest industrial application of high-frequency fluorescent lighting is planned for the new United Controls Co. plant in Seattle, Wash. The frequency conversion is by means of rotary frequency converters. The rotary frequency converters produce power at 575v and 840 cps.

At frequencies above 300 cps, it is possible to use simple capacitor ballasting in place of the more expensive and less efficient inductive ballasts. This gives a substantial saving in size and weight as well as an increase in overall fixture efficiency. The capacitive ballast used for high frequency is 1/10 to 1/7 the weight of inductive ballasts for 60 cycles. Ballast temperature rise is 1/10 to 1/3 inductive ballast rise, thus giving longer life.

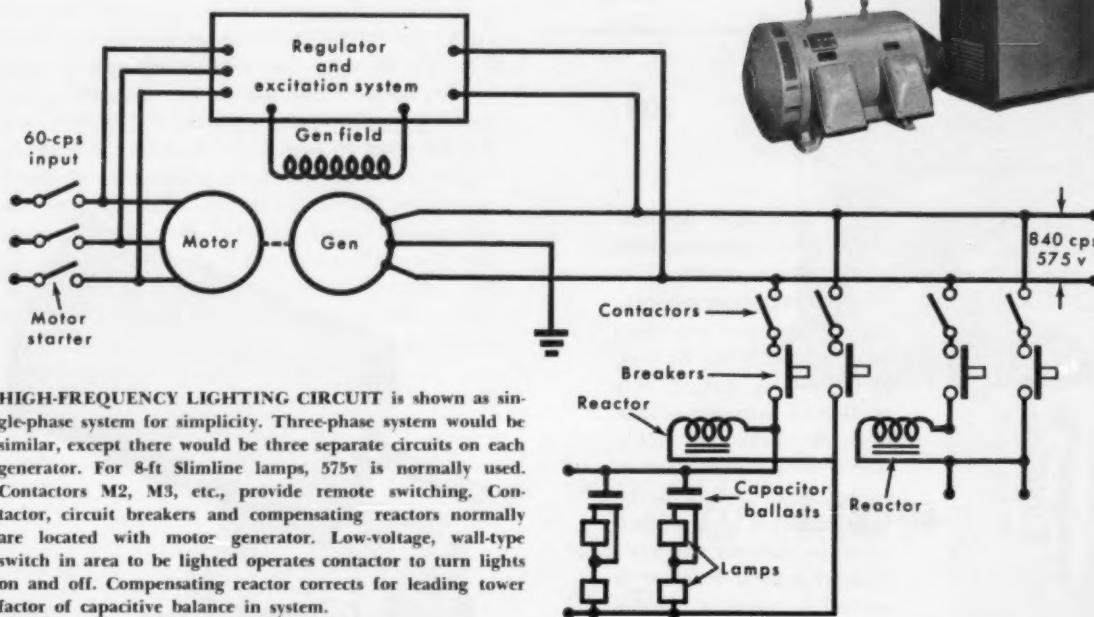
At higher frequency, Slimline light is 15 to 30 percent higher. The improved current and voltage wave shapes at the higher operating frequencies give a lamp power factor near unity. As the frequency of the lamp is increased, the degree of ionization tends to remain at an average, thus reducing re-ignition voltage as compared to 60-cycle systems.

The increase in impedance due to high frequency is not excessive at frequencies below 1000 cycles. For distributing large quantities of high-frequency power, it is desirable to use stranded conductors, non-magnetic conduit, close conductor spacing and to equalize the lead lengths on circuits operating from the same power supply.

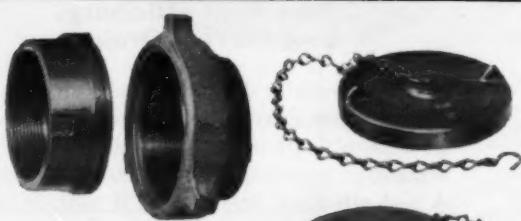
In factories, where a high level of illumination is required, high operating frequency for lamps results in fewer fixtures for the same light output. This results in savings in fixture and power costs. If the area is air conditioned, these requirements are reduced because less heat is added to the room.

High-frequency lighting for industrial applications is an outgrowth of developments in the ground support equipment field. Industrial high-frequency lighting is designed and produced by The Leach Corp., Compton, Calif.

## Efficiency of Fluorescent Lamps



**HIGH-FREQUENCY LIGHTING CIRCUIT** is shown as single-phase system for simplicity. Three-phase system would be similar, except there would be three separate circuits on each generator. For 8-ft Slimline lamps, 575v is normally used. Contactors M2, M3, etc., provide remote switching. Contactor, circuit breakers and compensating reactors normally are located with motor-generator. Low-voltage, wall-type switch in area to be lighted operates contactor to turn lights on and off. Compensating reactor corrects for leading power factor of capacitive balance in system.



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**CRYOGENIC COUPLINGS**  
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A NEW 12-inch Brake with 16 gauge steel capacity is available for forming smaller parts.

For free illustrated folder look under Machinery, Machine Tools, in the Yellow Pages for your Di-Acro distributor or write us.



1. **BOX AND CABINET FORMER** forms all widths from  $\frac{3}{4}$ " to 24" by  $\frac{1}{4}$ " steps.



2. **BAR FOLDER** folds or hemms up to 16 gauge mild sheet steel across full width.



3. **RADIUS FORMER** forms radii by positioning forming edge or with special radius fingers.



4. **OPEN END FORMER** forms open end shapes by replacing box fingers with open end finger.

## MORE QUALITY ENGINEERED FEATURES IN STEPHENS-ADAMSON CARRIERS

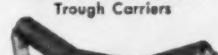


Series #200 Carriers

Series #700 Carrier



35° and 45° Deep Trough Carriers



Pneumatic "Impact" Carriers

### ADVANTAGES

- Spun-end roller assemblies and parts interchangeable for quick installation.
- One-Piece, all-steel, welded frame construction.
- Positive lubrication . . . pre-lubricated at factory . . . provisions for field lubrication.
- Roller brackets tilt two degrees in direction of travel for greater belt training effect.
- Die-cast labyrinth bearing seals keep grease in . . . dust and dirt out.

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# NEW PRODUCTS

## MECHANICAL

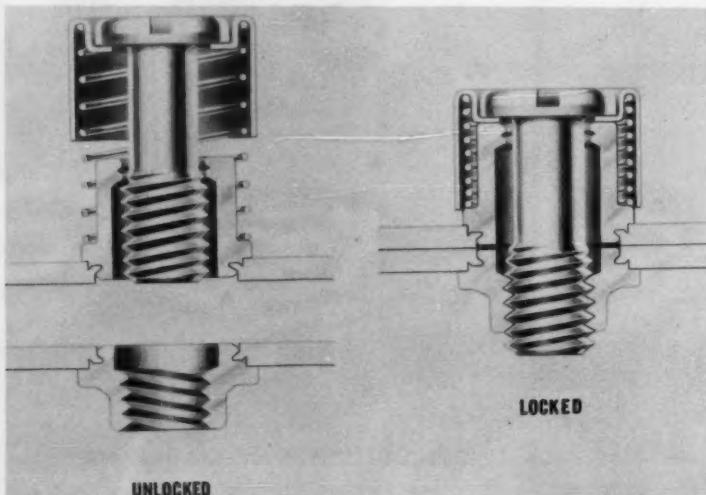
### Panel Fastener

#### Offers Simplicity in Installation

Only a single hole is needed to accept the P-series fastener's press-in type retainer which is readily installed with hand or power tools. The fastener

assembly is useful for removable-panel applications found in the electronic and instrumentation industries. Fastener can be used in combination with NAS576 type self-locking nuts, press-in type nuts or in tapped holes. Because of its floating feature, bolt portion of assembly accommodates misaligned holes. Bolt is spring loaded, which allows bolt threads to be fully retracted and protected when fastener assembly is not engaged. Fastener is offered in single or double lead threads and in sizes ranging from 4-40NC-3B to 1/4-28UNF. Basic fasteners are available in alloy steel and titanium configuration.

Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

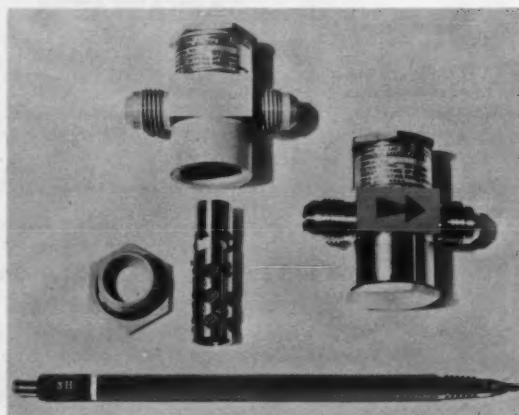


### Miniature Fluid Filter

#### Features In-Line Ports, Adjustable By-Pass

A fluid filter system weighing only 2 oz allows straight-through flow, minimizing pressure drop. The unit, model P/N 1850, features in-line ports and an adjustable by-pass. By-pass ball valve permits full fluid flow in case of filter clogging; it can be adjusted to open through a pressure-drop range of 20 to 100 psi. Filtering element is composed of a stainless-steel mesh, 1 1/2 square inches in area. Filter mesh can be removed from either end of body. The filter can be completely assembled or disassembled without danger of wrong orientation of parts, making it useful in ground support and field operations.

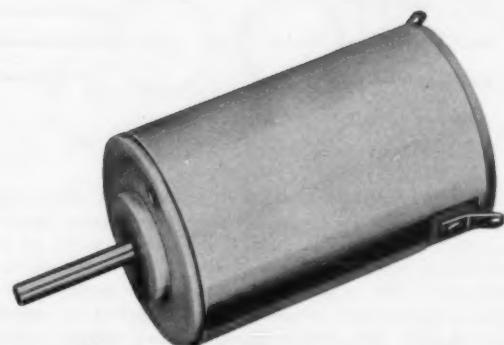
Pyrodyne, Inc., 11973 San Vicente Blvd., Los Angeles 49, Calif.



303

For more information on products described, circle on the Reader-Service Card the numbers appearing opposite the story headlines and drop the card in the mail.

301



Battery-Operated Motor 302

#### Offers High Efficiency, Low Current Drain

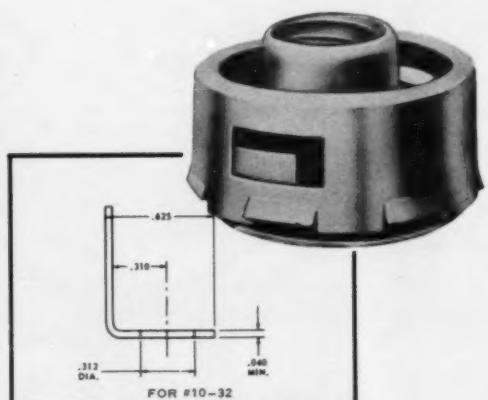
A 1-inch diameter d-c motor is ideal for applications where space is limited and weight must be kept to a minimum. The unit has a 6-pole armature, providing good electrical balance. A high-efficiency field magnet is used. Square brushes have pigtail connections and constant spring pressure is applied over entire useful life of brush. Brush holders are molded from corrosion-resistant acetal resin. Self-aligning sintered bronze sleeve bearings are standard. Governed speed can be set from about 1500 to about 5000 rpm, and torque is 0 to 0.20 oz-in. Rotation is normally clockwise or counter-clockwise, as required. Bi-directional operation is good. Electrical specifications include: voltage range, 4.5 and 30v d-c; current range, dependent on load (customarily expressed in milliamps). This miniaturized rotary component is suitable for operation in ambient temperatures up to 200°F.

Barber-Colman Co., Motors & Components Div., Rockford, Ill.

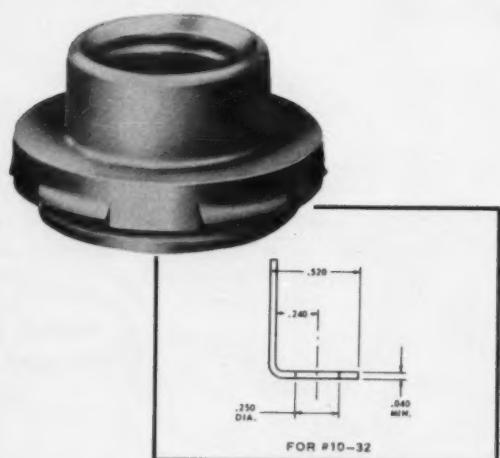
**Provide High Installed Reliability  
In Thin-Section Materials**

Floating and non-floating fasteners save up to 33 percent hardware weight and make possible significant space-saving in staking operations. Minimum thickness requirements for nuts are 0.040 and 0.030 inch, making possible reduction of parent material thicknesses. Application provides maximum installed reliability of threaded elements in thin-section materials. Push-out, torque-out and thread-locking features each exceed requirements of MIL-N-25027. Installation is simple—a single hole is all that is needed, and it may be punched or drilled. Self-staking operation provides cold flow of parent material in such a manner that an interlock is created between parent material and part.

Kaynar Mfg. Co., Inc., Kaylock Div., Box 2001, Terminal Annex, Los Angeles 54, Calif.

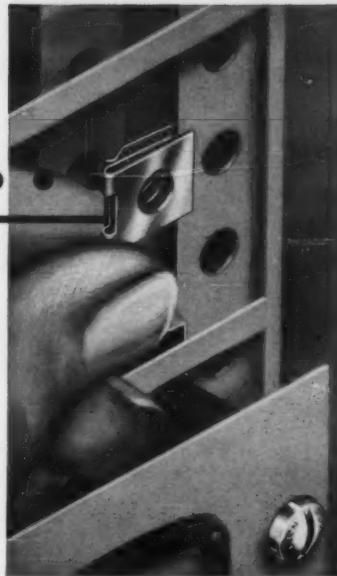


TOOL CLEARANCE



TOOL CLEARANCE

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**clip-on  
receptacle cuts  
1/4 turn fastener  
installation  
time by 86%**

**for LION 1/4 turn FASTENERS**

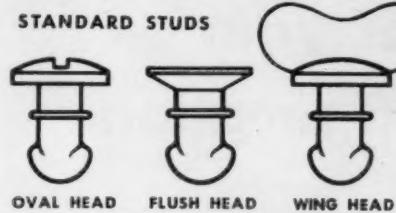
Riveting and welding are eliminated by the new, time-saving clip-on receptacle that just slips over a hole in your door frame and locks itself in place.

The Lion stud is as easily installed. Slipped through a hole in the panel or door, it is captivated by a split ring retainer. Both the stud and receptacle have a generous "float" to tolerate misalignment of parts.

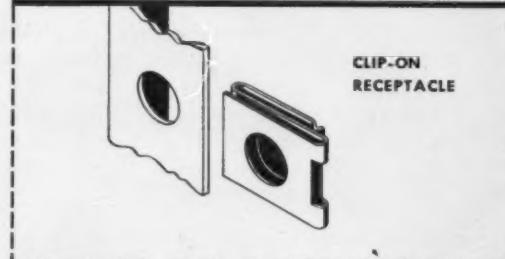
Operation is fast— $\frac{1}{4}$  turn to lock,  $\frac{1}{4}$  turn to unlock.

FREE!

For complete information on this and other fasteners, send for your free copy of Southco Fastener Handbook, Southco Division, South Chester Corporation, 232 Industrial Highway, Lester, Pa.

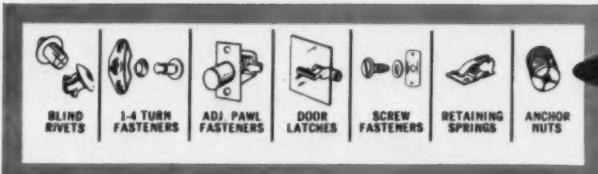


Material: steel, case hardened  
Finish: Cadmium plate per QQ-P-416 Type I Cl. 1.



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**SOUTHCO** **FASTENERS**  
**LION**

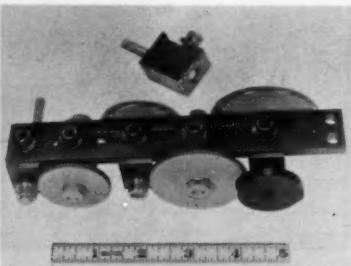


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**Quick-Change  
Gear Chassis**

305

Designed to be incorporated into any mechanism where gear ratios must be quickly changed or where a specific gear train has to be assembled quickly, this chassis makes it possible to obtain a wide range of ratios with maximum simplicity. Among many possible applications, it can measure linear distance when driven by a measuring wheel of known circumference or any time interval when driven by a small synchronous motor. Precision instrument gears are mounted with set screws on both ends of a shaft which rotates in a ballbearing housing. Housing and gears can be slid along a track which keeps shafts properly aligned for accu-



rate mating of gears with other gears in similar housings. Four bearing housings with shafts and a slide track are standard equipment. Additional bearing housings, micro-switch holder, cams, precision 12-inch circumference wheel for linear measurement and standard instrument gears are available as required. Illustration shows typical assembly with driving shaft at left, four pair of gears and driven cam. Assembly illustrated is an extra bearing housing. Overall center line distance available in stock model is 5-7/16 inches.

Foster & Allen, Inc., 26 Commerce St., Chatham, N. J.



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## your guide to the gear pump for your application

*This new catalog is an invaluable directory to no less than 129 pump-and-electric-motor-combinations — any and all available off-the-shelf!*

Searching for gear pumps with top volumetric efficiencies? Do your performance requirements fall into one of these three major groups?

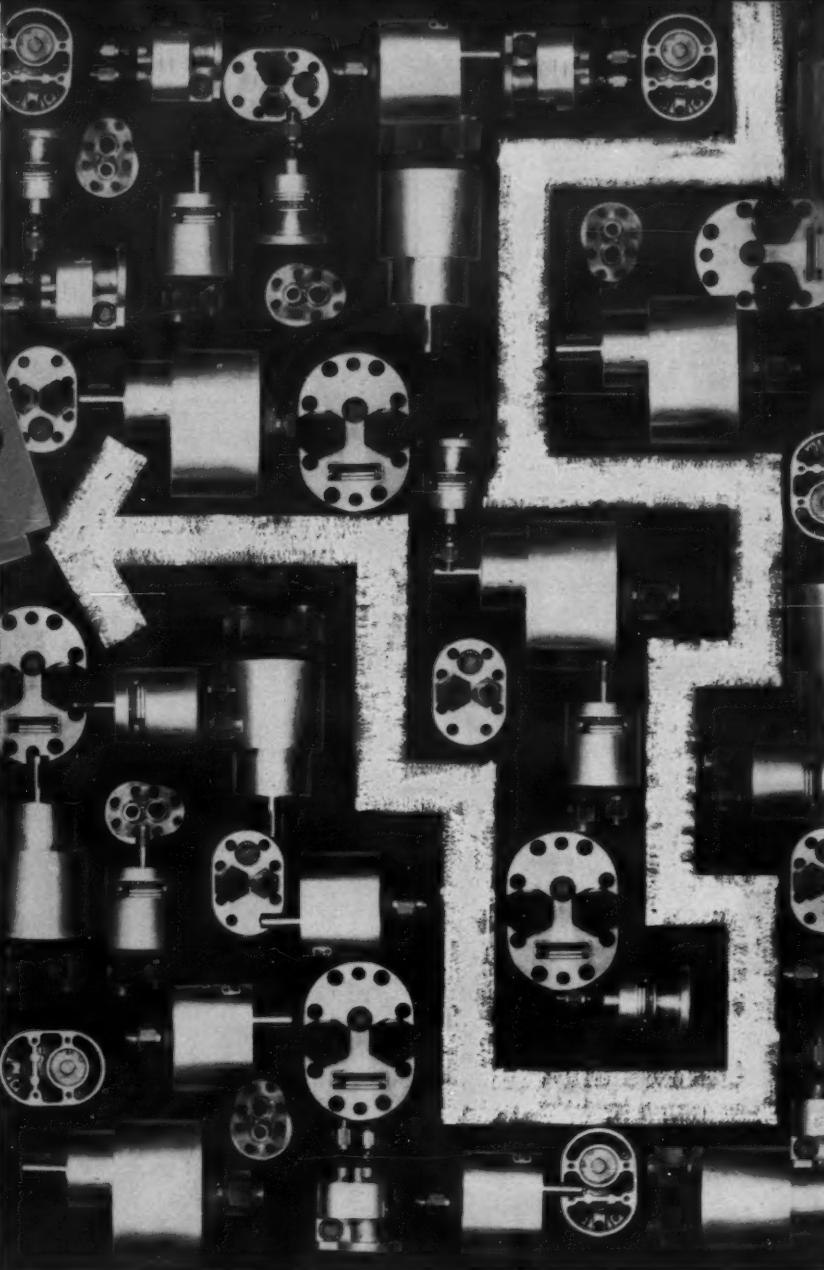
- Eastern 1200 series — up to 1.6 gpm — pressures to 800 psi
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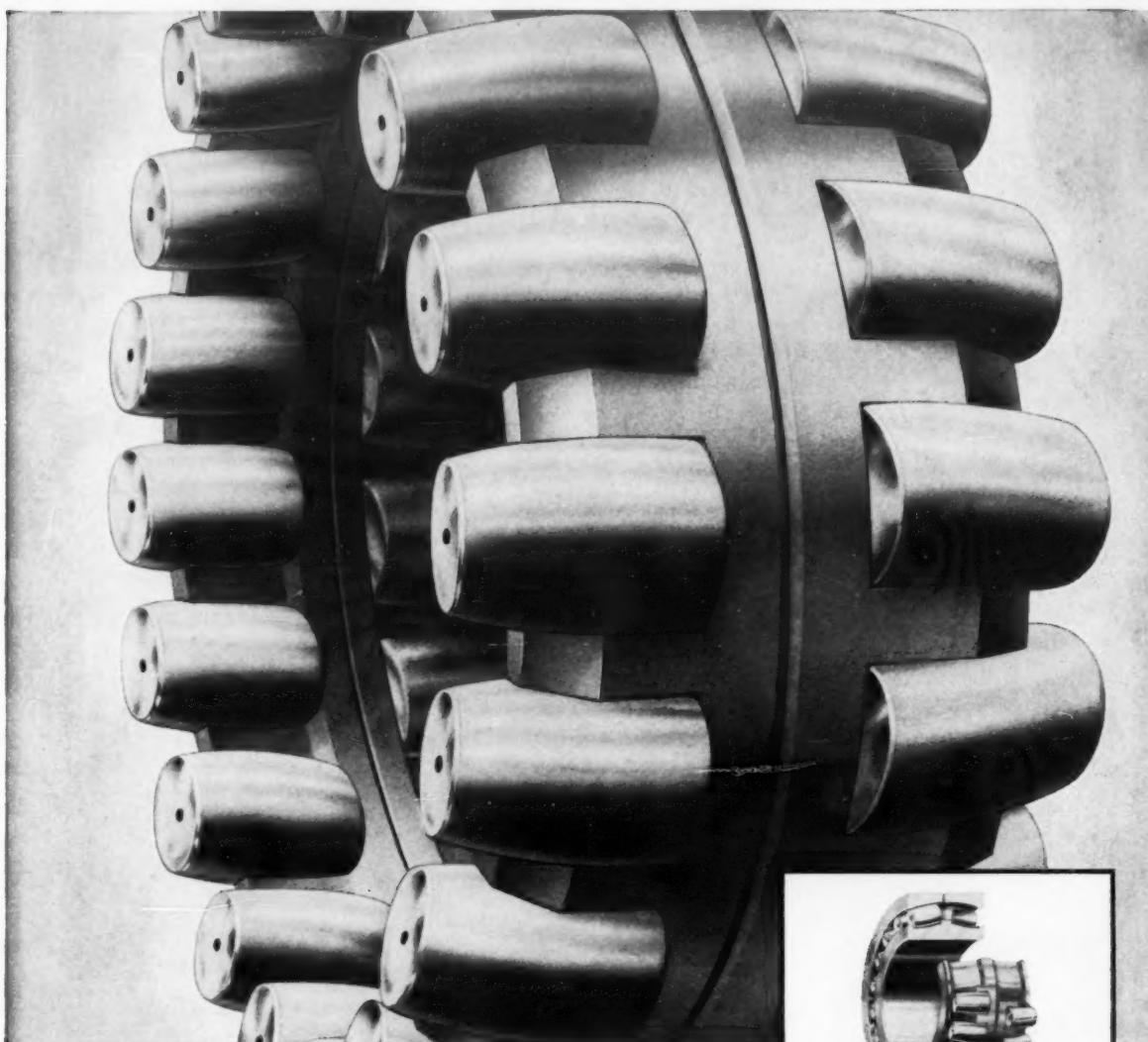
**EASTERN  
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Hamden, Connecticut



- Eastern 700 series — up to 9.8 gpm — pressures up to 1500 psi

If one or more of these performance ranges measures up to what you need, save hours of searching your way through the gear pump maze — send for catalog 810 now!





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### Superior design features of TORRINGTON SPHERICAL ROLLER BEARINGS

- integral guide flange for roller stability
- asymmetrical rollers seek flange for positive guidance
- electronically matched rollers
- size-stabilized races
- fully machined land-riding bronze cages
- controlled internal clearances
- even load distribution
- inherent self-alignment
- long service life

*progress through precision*

**TORRINGTON BEARINGS**

**THE TORRINGTON COMPANY**

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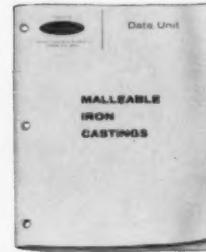
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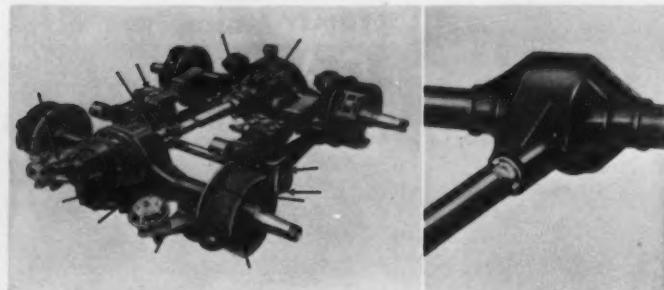


For Free Literature on advantages of Malleable iron castings, with examples from the automotive industry, ask any member company for Data Unit No. 113, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

MEMBER



Testifying to Malleable's outstanding ability, pearlitic Malleable iron crankshafts are now used in both cars and trucks, like this new heavy-duty highway hauler. Pearlitic Malleable was chosen for its high strength, wear resistance, damping capacity and machinability. Malleable is the most machinable of all ferrous metals of similar properties.



From the smallest cars to the largest trucks, all American vehicles rely on Malleable for a range of uses. In this tandem axle, for example, a total of 36 parts is Malleable.

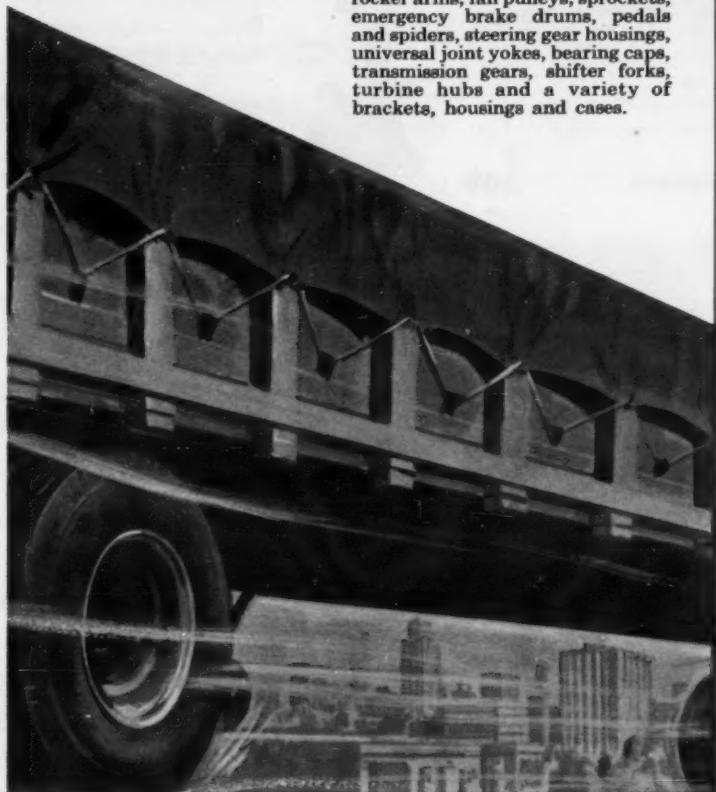
Malleable differential carriers form the backbone of the rear axles on many new compact cars, as shown at the right above. Tubular steel extensions are pressed into the Malleable housing where they are "puddle" welded. Decisive factors in Malleable's selection were strength, economy, ease of machining and ability to be produced in a design that required a minimum of tooling expense.



The increasing conversion from other materials to Malleable castings for all kinds of parts from crankshafts to door hinges is adding momentum to the automotive

industry's steadily increasing use of Malleable.

Among the many Malleable iron castings in this composite car are torsion bar arms and brackets, rocker arms, fan pulleys, sprockets, emergency brake drums, pedals and spiders, steering gear housings, universal joint yokes, bearing caps, transmission gears, shifter forks, turbine hubs and a variety of brackets, housings and cases.



Circle 55 on Reader-Service Card for more information

## For Quality and Economy Use

**MALLEABLE**

### For Service Contact...

#### CONNECTICUT

Connecticut Mall. Castings Co., New Haven 6  
Eastern Malleable Iron Co., Naugatuck

#### DELAWARE

Eastern Malleable Iron Co., Wilmington 99

#### ILLINOIS

Central Fdry. Div., Gen. Motors, Danville  
Chicago Malleable Castings Co., Chicago 43  
Moline Iron Works, Moline  
Moline Malleable Iron Co., St. Charles  
National Mall. and Steel Castings Co., Cicero 50  
Peoria Malleable Castings Co., Peoria 1  
Wagner Castings Company, Decatur

#### INDIANA

Albion Malleable Iron Company, Muncie Division, Muncie  
Link-Belt Company, Indianapolis 6  
National Mall. & Steel Castings Co., Indianapolis 22

#### IOWA

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#### MASSACHUSETTS

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#### MICHIGAN

Albion Malleable Iron Co., Albion  
Auto Specialties Mfg. Co., Saint Joseph  
Cadillac Malleable Iron Co., Cadillac  
Central Fdry. Div., Gen. Motors, Saginaw

#### MINNESOTA

Northern Malleable Iron Co., St. Paul 6

#### MISSISSIPPI

Mississippi Malleable Iron Co., Meridian

#### NEW HAMPSHIRE

Laconia Malleable Iron Co., Laconia

#### NEW YORK

Acme Steel & Mall. Iron Works, Buffalo 7  
Frazer & Jones Company Division  
Eastern Malleable Iron Co., Solvay  
Oriskany Malleable Iron Co., Inc., Oriskany  
Westmoreland Mall. Iron Co., Westmoreland

#### OHIO

American Malleable Castings Co., Marion  
Central Fdry. Div., Gen. Motors, Defiance  
Dayton Mall. Iron Co., Ironton Div., Ironton  
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16  
National Mall. and Steel Castings Co., Cleveland 6

#### PENNSYLVANIA

Buck Iron Company, Inc., Philadelphia 22  
Erie Malleable Iron Co., Erie  
Lancaster Malleable Castings Co., Lancaster  
Lehigh Foundries Company, Easton  
Meadville Malleable Iron Co., Meadville  
Pennsylvania Malleable Iron Corp., Lancaster

#### TEXAS

Texas Foundries, Inc., Lufkin

#### WEST VIRGINIA

West Virginia Mall. Iron Co., Point Pleasant

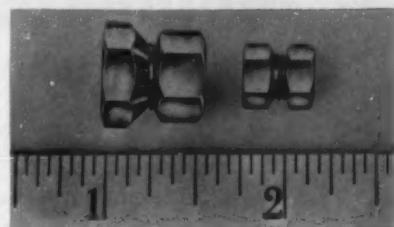
#### WISCONSIN

Bell City Malleable Iron Co., Racine  
Chain Belt Company, Milwaukee 1  
Federal Malleable Company, Inc., West Allis 14  
Kirsh Foundry Inc., Beaver Dam  
Lakeside Malleable Castings Co., Racine  
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

These companies are members of the Malleable Castings Council

## Shaft Locks

306

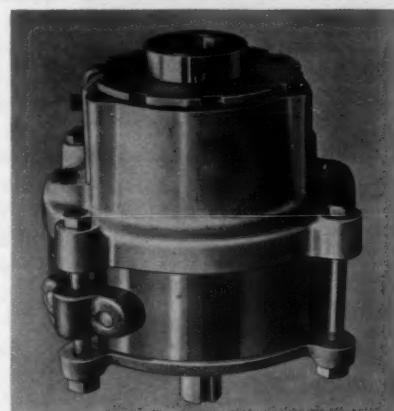


Wrench-type shaft locks for use on such components as volume controls, coils and capacitors are manufactured of brass per QQ-B-626a,  $\frac{1}{2}$  hard. Lock No. 2038 for  $\frac{1}{8}$ -inch diameter shafts is  $\frac{3}{8}$ -inch overall length with  $11/32$ -inch hex locking nut and  $11/32$ -inch hex collet ( $1/4$ -32 thread). Lock 1774 for  $\frac{1}{4}$ -inch diameter shafts is  $\frac{1}{2}$ -inch overall length with  $\frac{1}{2}$ -inch hex locking nut and  $9/16$ -inch hex collet ( $\frac{3}{8}$ -32 thread). All are available in black oxide finish or with heavy nickel plating. High production quantities of both sizes are available.

Cambridge Thermionic Corp., DN Concord Ave., Cambridge 38, Mass.

## Shaft-Mounted Gear Reducer

307



A planetary gear reducer with ratios from  $3\frac{1}{2}:1$  to  $36:1$  is offered in either steel or aluminum housing. Horsepower range is from 4 to 30 and higher ratios and horsepower are available in standard foot-mounted units. The device offers up to 50-percent savings in weight and space, the manufacturer states.

Crichton Co., Johnstown, Pa.



on airborne accessories  
with...

# LONG- LOK

## self-locking screws

Per MIL-F-18240



Critical weights and needless and costly man-hours of assembly time are being saved through the use of **LONG-LOK** Self-Locking Screws on pressure switches, motors, pumps, valves and other airborne accessories.

Many companies in the aircraft, missile and rocket fields are using **LONG-LOK** Self-Locking Screws per the requirements of MIL-F-18240 to simplify their assemblies.

**LONG-LOK** Self-Locking Screws are heat, vibration, shock and impact resistant. They are reusable and can be head marked for self-lock identification per specification. Increased reliability of component and system is assured.

**LONG-LOK** Self-Locking Screws are solving new fastener problems every day. They could be the answer to your needs.

Write for Catalog LL-60

### LONG-LOK CORPORATION

2601 Colorado Avenue • Santa Monica, Calif.  
UPton 0-6335 • TWX 5 MON 7146

### LONG-LOK EASTERN CORPORATION

68 Urban Avenue, Westbury, L. I., New York, EDgewood 4-8154

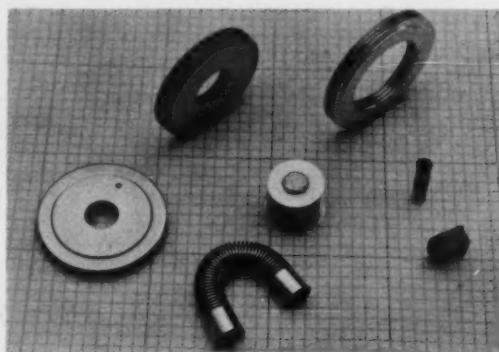
LICENSEES AND REPRESENTATIVES IN PRINCIPAL CITIES

Circle 56 on Reader-Service Card for more information

## MECHANICAL

### Miniature Bellows

308

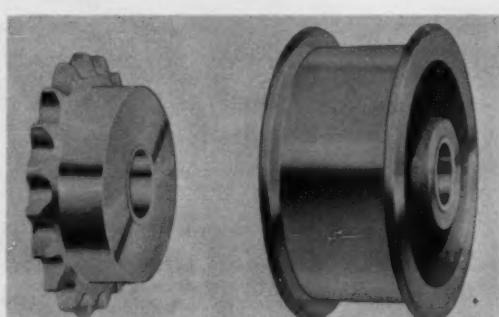


Precision instrument bellows and sensitive diaphragms are available from the development of a new process that permits a wide selection of sizes, shapes and proprietary alloys. Wall sections of 0.0005 to 0.005-inch are available in materials suitable for high-temperature, high-pressure and non-magnetic applications. Custom bellows assemblies are in production for force balance, volumetric compensation and motion applications. A complete custom-design engineering service is available.

Kinematic Corp., P. O. Box 386, Huntington Station, L. I., N. Y.

### Bronzed Bushed Idlers

309



A complete line of bronzed bushed idlers is manufactured in 14 standard sizes, with 1-inch standard bores. Sprockets are made in standard sizes from No. 35 through 80 roller chains in single and double widths. Pulleys are made in 1, 2 and 3-inch face widths with a 4-inch dia and are used with V, flat and timing-belt drives.

Brewer Machine & Gear Co., 1441 N. 2nd St., St. Louis, Mo.

## ROTARY AIR GAST PRODUCTS



Model 2065 with motor,  
Gast base and coupling.

## Solve your product problems — specify positive displacement GAST AIR COMPRESSORS



To enjoy excellent performance-per-pound . . . through years of demanding service . . . specify Gast heavy-duty Air Compressors. Forced-air dual fan cooling and automatic lubrication permit 'round-the-clock operation at rated pressures.



Design is simple and trouble-free. A rotor and four sliding vanes are the only moving parts. Vanes take up their own wear automatically to maintain "like new" efficiency for years. Air delivery is pulseless and positive in displacement. They're compact (no bulky tank needed) — and adaptable for direct coupling or V-belt drive. Supplied on base, coupled to motor if desired.



As original equipment or for plant service, they may help you solve design problems! May we send complete data?



Model No.	Rec. Max. Pressure, p.s.i.g.				Net Wt. Lbs.
	C.F.M. @ 0 p.s.i.g.	Con- tinu- ously	Inter- mit- tently	Motor h.p.	
0465	4.0	25	30	1/2	18
0765	5.9	10	15	1/2	18
1065	8.3	25	30	1	33
2065	17.0	15	20	1 1/2	52
2565	21.0	15	20	2	51
4565	45.0	15	20	5	92

\*Without base or electric motor.

WRITE TODAY FOR BULLETIN P-HD.

GAST MANUFACTURING CORP., P.O. Box 117-G  
Benton Harbor, Michigan

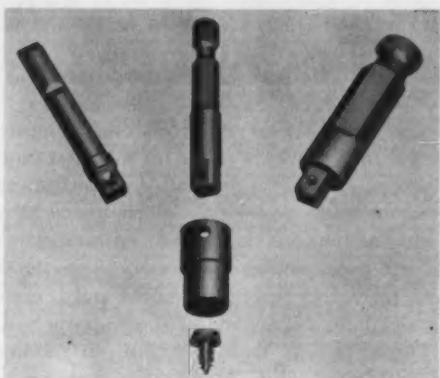
## GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"



Circle 57 on Reader-Service Card for more information



The action of a self-drilling, self-tapping screw tends to cause unusual wear and breakage on sockets used to drive this type of screw. The M1A08 socket, designed and built of special materials to withstand stress and shock, eliminates down-time and cost involved when sockets must be replaced frequently. Socket is magnetic, to hold fastener firmly in position from start to finish of driving operation. It is used in conjunction with extensions available in a range of shank types to fit well-known makes of power tools.

Apex Machine & Tool Co., 1025 So. Patterson Blvd., Dayton 2, Ohio.



Double-acting or spring return, CLA series 1 1/8-inch bore air cylinders deliver 150 psi air, 250 psi hydraulic. Stud-mounted units are 1 1/2 inches square, with short overall length and light weight through use of machined aluminum bar stock heads. Sintered bronze bushing in rod head gives improved bearing surface for stainless-steel piston rod. Rod seals are of "Block Vee" type for good seal with low friction factor. Cylinder tubes are drawn brass. Pistons are aluminum, secured with a roll pin. Head seals are flat gaskets, retained type, to prevent extrusion. Ports are 1/8-inch dry seal pipe thread. Cylinder assembly is held together with high-tensile steel tie rods. Jam nut is provided for mounting on 5/8-inch long stud threaded 5/8-18 NF-8.

Sheffer Corp., 326 W. Wyoming Ave., Cincinnati 15, Ohio.

# SUPER-SPEED-SUPER-POWER

from this  
2 1/2" Bore

## AIR CYLINDER



Model BNSSEM-SC Super-Speed Air Motor equipped with electrically-operated valve.

This special machine designed and built in the plant of Electro-Mechanical Products Co., clamps and pierces 3 holes in 20,000 pieces per day. It uses 3 Bellows Super-Speed Air Cylinders and a Bellows Air Motor. Set-up cost 1/3 the price of a punch press die.

This Super-Speed® Bellows Air Motor® is so powerful it can drive a 1/2" hole through 1/16" thick steel. The piston rod moves at a speed six to ten times the speed of an equivalent sized air cylinder.

That's why the Super-Speed is an ideal answer to many piercing, staking, forming, riveting, stamping, swaging and similar operations.

The Super-Speed Air Motor uses the basic

Bellows integral valving system with built-in operating and speed controls. Only one air connection is required which can be flexible hose. The directional valve may be either the low-voltage (8-12V) Electro-aire® Valve or the finger tip control manual valve. One bore size, 2-1/2". Four standard stroke lengths, 4", 6", 9" and 12".

Write for Bulletin SS-5R. Address Dept. DN-161, Bellows-Valvair, Akron 9, Ohio.

**More than 200 Bellows-Valvair Field Engineers are at your service**

**Bellows-Valvair**  
AKRON 9, OHIO  
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

Circle 58 on Reader-Service Card for more information

WEATHER  
Fair, Mild

T-J

TOMKINS-JOHNSON TRIBUNE

★★★★★  
FINAL

THE TOMKINS-JOHNSON CO. • 2426 W. Michigan Ave. • Jackson, Michigan

# INCREASED PRODUCTION... CREATES PRICE ADJUSTMENT on T-J Squair Head Cylinders

JACKSON, MICH. JAN. 3 (TP)—"Due to the tremendous initial response and the continuing acceptance and purchase of the new Tomkins-Johnson Squair Head Cylinders, it has been possible to lower the basic price," according to T-J personnel. In effecting this price cut, Tomkins-Johnson has again proven that acceptance of a quality product and the inevitable increase in manufacturing volume CAN economically justify a price reduction WITHOUT jeopardizing quality.

The T-J Squair Head Cylinder, an interchangeable air cylinder for any pneumatic power application, was first introduced by Tomkins-Johnson in 1958. It was an immediate success because of

its availability in a wide range of bore sizes and strokes . . . as well as the standard quality features, including the new T-J Super-Cushion for air cylinders.

#### Other Standard Features

Other standard T-J features that allow the T-J Squair Head Cylinder to retain its high quality comparison over other makes of air cylinders and still give you lower price are: solid steel heads and mounting plates, hard-chrome plated bodies and piston rods, leak-proof cylinder head to body construction, heavy duty, high tensile ground and polished chrome, plated piston rod, and many more . . . STANDARD

#### AT NO EXTRA COST.

Tomkins-Johnson, by virtue of the announced lower cost on its Squair Head Cylinder, wish to thank their customers for their initial acceptance which has been such a contributing factor in this price reduction.

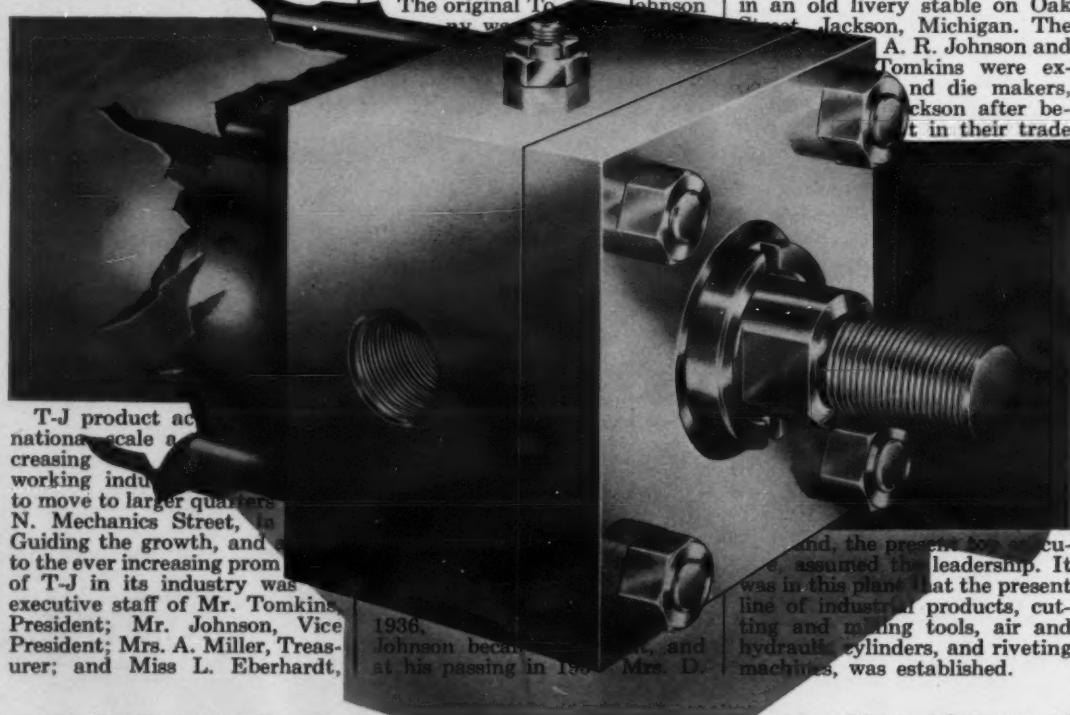
#### T-J Produces Complete Line

Tomkins-Johnson also produces a complete line of hydraulic and pneumatic cylinders for EVERY power drive application . . . including the very popular Spacemaker. If you need further information or complete catalog material, write T-J direct, or request it from your T-J sales representative.

#### The Tomkins-Johnson Company was founded in 1917

The original To...

Johnson | in an old livery stable on Oak Street, Jackson, Michigan. The A. R. Johnson and Tomkins were ex-nd die makers, Jackson after be-  
t in their trade



T-J product ac-  
nationally scale a  
increasing working in-  
to move to larger quarters  
N. Mechanics Street, in  
Guiding the growth, and  
to the ever increasing prom-  
of T-J in its industry was  
executive staff of Mr. Tomkins,  
President; Mr. Johnson, Vice  
President; Mrs. A. Miller, Treasurer;  
and Miss L. Eberhardt,

1936,  
Johnson became  
at his passing in 1941. Mrs. D.

and, the present top executives assumed the leadership. It was in this plant that the present line of industrial products, cutting and mining tools, air and hydraulic cylinders, and riveting machines, was established.

Circle 59 on Reader-Service Card for more information

## MECHANICAL

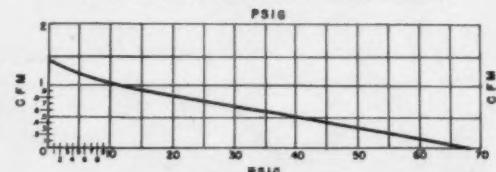
### Oil-Less Motor Compressor 312

A miniature 1/12-hp motor-powered compressor and vacuum pump is suited to a wide range of industrial, laboratory and office uses. Two models are offered: model LV, which has a 1.9 cfm displacement and is capable of continuous operation up to 27 inches vacuum; and model LC, which has a 1.43 cfm displacement and is capable of continuous operation up to a pressure of 65 psi. Both models include a built-in automatic overload prevention mechanism that prevents



#### MODEL LC

AVERAGE FREE AIR DELIVERY AT VARIOUS PRESSURES



motor failure in the event of abnormal electrical conditions. Units, weighing 18 lb, operate at 1725 rpm with split-phase, induction-type motors. They come complete with carrying handle, 8-ft cord and plug (115v only), intake filter (cylinder head port is 1/2-inch NPS), 1/4-inch IPS discharge (or intake on vacuum pump) connection, and four rubber-base cushions.

Bell & Gossett Co., Morton Grove, Ill.

## UNUSUAL BARGAINS

ORDER BY STOCK NO. • CHECK — M.O. • SATISFACTION OR MONEY BACK



### NEW! NEW! NEW! DOUBLE ENDED CLIPS!

Honesty gadgets ever . . . hundreds of uses in industry! Spring action — squeezes to open either end. Use them for drying photographic prints, collating research or design notes for ready reference, displaying plans or sketches at meetings, keeping production orders together, hanging up samples or bulletins, etc. Made of white plastic, 2" long. Durable. Easily cleaned.

Stock No. 70,402-CD Pkg. of 100 — \$8.95 Pspd.



### Low-Cost INDUSTRIAL THROWAWAY KNIVES

Superior to ordinary industrial cutting tools for slitting, trimming, cutting or slicing. Yet so low cost (only 3¢ each!) you can throw them away when dull. No danger or wasted time from changing or sharpening knife blades, or handling razors. Ideal for use on textiles, linoleum, plastic materials, paper products. Length 3" with a 2" razor sharp steel blade.

Stock No. 70,372-CD Pkg. of 100 — \$3.00 Pspd.



### HANDY REVERSIBLE MULTI-USE PUMP

You'll find important lab or industrial uses for this unique pump. Reversible feature makes it ideal for siphoning liquids into or out of jars, bottles, containers. Use for sampling, testing, experiments. Fits bottles and cans with openings from 3/4" to 1-1/16". Supplementary adapter plug is included. Consists of bellows plus clear plastic tubing — one 18", the other 12" long.

Stock No. 70,403-CD 3 for \$5.95 Pspd.



### STEREO MICROSCOPE — Terrific Buy! American Model

Up to 3" Working Distance—Wide 3 Dimensional Field. Used in production, in research, or at home. 2 sets of objectives on rotating turret. Standard pair of wide field 10 X Kellner Eyepieces give you 23 power and 40 power clear, sharp, erect image. Helical rack and pinion focusing. Interchangeable distance adjustable. SO GOOD WE'LL SHIP ON 10-DAY FREE TRIAL.

Stock No. 85,656-CD full price \$99.50 f.o.b.

### FREE! Giant 144-Page CATALOG "CD"

OVER 1,000 SCIENCE-MATH-OPTICAL ITEMS for industry . . . Many on-the-job helps . . . quality control aids! 144 pages—hundreds of illustrations. Many war surplus bargains! Imported instruments! Lenses, Prisms, Magnifiers, Telescopes, Satellite Scopes, Microscopes, Binoculars, etc. Optics for industry, research labs, experimenters, hobbyists, math learning aids. Write for FREE Catalog CD.

**EDMUND SCIENTIFIC CO., Barrington, N. J.**  
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## Strong fastening for cover plates with RIVNUTS®

Cover plates on this hydraulic tank are fastened by bolts threaded into RIVNUTS. This provides a strong, leakproof joint. RIVNUTS project inside the tank, eliminating possible damage in use. RIVNUTS are the only one-piece blind rivets with internal threads—used in thousands of fastening applications. For RIVNUT Data Book write *B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Dept. DN-1, Akron, Ohio.*

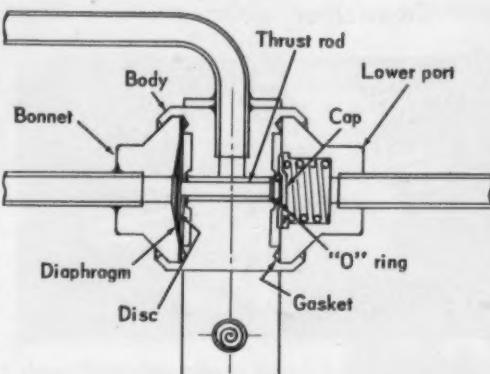
## B.F.Goodrich Rivnuts

Circle 61 on Reader-Service Card for more information

DESIGN NEWS—JANUARY 16, 1961

## Miniature Diaphragm Motor Valve

313



Design applications of this packless unit are underground pressurized cables. Valve is buried underground with cable end (the single tubing) coupled to pressurized cable. "Operate" and "Read" tubings are led to surface. Pneumatic pressure on "Operate" tube opens spring-loaded valve and amount of air pressurization in underground cable can be read at surface from "Read" tube. Air can also be supplied to underground cable by pneumatic pressure on "Read" tube. A-2399 is made of corrosion-resistant alloys, tin plated.

George W. Dahl Co., Inc., 86 Tupelo St., Bristol, R. I.

## Synchro/Integral-Brake

314



A MIL-type unit consisting of a synchro-receiver and an integral brake which closes to lock receiver in position measures 2-3/16 by 1-1/6 inches and weighs 4 1/2 oz. Receiver consists of a 26v, 400-cycle synchro with 1.5-deg accuracy under environmental conditions, and an integral brake solenoid available with 35v d-c or 115v d-c. Type 9614-02 has 2-seconds damping time, solder-type tubular lugs and hermetically sealed case.

John Oster Mfg. Co., Avionic Div., Racine, Wis.

## FEL-PRO C5-A

Colloidal Copper Compound

has dozens of uses as a

## Sealant•Protectant•Lubricant

This PROVEN "Hi-Temp" Compound, originally designed for use as an anti-seize compound for difficult high temperature application is now being successfully used on such products as:

- valve bodies • tape recorders • manifolds • milling machines • aircraft and missiles
- jet engines • pumps • drills
- heat exchangers, etc.

Wherever an application calls for superior lubrication, high pressure sealing or protection from rust and corrosion, Fel-Pro C5-A colloidal copper compound may be a new low cost answer.

C5-A prevents seizing and galling. Protects stainless steel in high pressure, high temperature applications. It can be used on all metals, alloys and most plastics. You'll find many cost cutting, performance increasing ideas in the Free Bulletin. Send for a copy of the C5-A Bulletin now.

**FELT PRODUCTS MFG. CO.**  
7450 North McCormick Blvd., Skokie, Illinois  
Dept. 86, (Chicago suburb)

Circle 62 on Reader-Service Card for more information



## Famous G.S. Precision Guards Your Production

Whether you need hundreds or thousands, G.S. gives you a degree of UNIFORM accuracy unapproached by any other Small Gear maker in the world! That assures smooth, dependable performance and low assembly costs.

G.S. Small Gearing is mass-produced in a range of sizes from 8 to 96 dp . . . from 1/8" to 8" diameters, and from any Gear material. Capable G.S. engineers will gladly help you develop the ONE best and most economical design for your specific needs. Send drawings and specifications or a complete description.

SEND FOR FREE  
Illustrated Small  
Gearing Guide



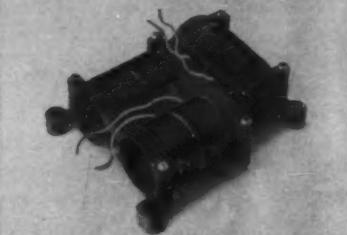
**GEAR Specialties, Inc.**  
Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing  
2635 WEST MEDILL AVENUE, CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS  
OF FRACTIONAL HORSEPOWER GEARS

Circle 63 on Reader-Service Card for more information



**Electrofilm**



## SPRAYED-ON HEATING ELEMENTS

Electrofilm's sprayed on — film type heating elements are especially designed for hard to heat contour surfaces. The element can be applied directly to the part . . . or to detachable components.

- **LIGHT WEIGHT**  
.07 lbs./sq. ft.
- **THIN**  
.011" to .015" (approx.)
- **ENVIRONMENT**  
Meets mil E-5272-A Spec.



Write for  
detailed  
technical data.

**Electrofilm INC.**

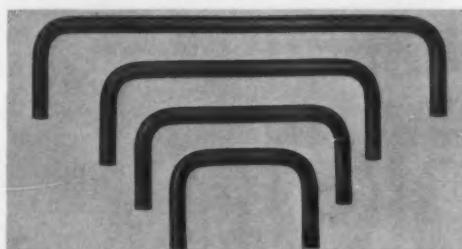
P.O. BOX 106, NORTH HOLLYWOOD, CALIF.

Circle 66 on Reader-Service Card

DESIGN NEWS—JANUARY 16, 1961

## Panel Handles

317

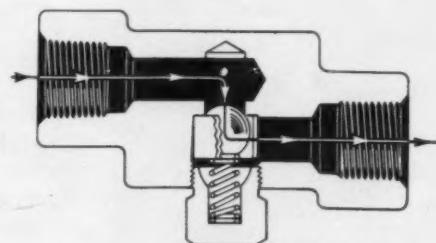


Four lengths and four different finishes of panel handles are being offered. Handles are  $\frac{1}{4}$  inch in diameter and are available in both brass and aluminum. Handle sizes and part numbers are: 2 by  $1\frac{1}{2}$  inches, 1290 (aluminum) and 1280 (brass); 3 by  $1\frac{1}{2}$  inches, 1291 (aluminum) and 1281 (brass); 4 by  $1\frac{1}{2}$  inches, 1292 (aluminum) and 1282 (brass); 6 by  $1\frac{1}{2}$  inches, 1293 (aluminum) and 1283 (brass). Brass rod is per ASTMB-121, alloy 4, with black oxide finish or light polish and 0.0005-inch nickel plate. Aluminum is 2011-T3 rod, per QQ-A-365, Comp. A, Temper T3 with black alumilite finish E-516, per MIL-F-14072 or alumilite 204 semi-frost. Mounting threads are No. 8-32 NC-2B. Ferrules 1211 for brass and 1212 for aluminum are available for use with handles.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

## Hydraulic/Air-System Check Valve

318



This device incorporates a sensitive ball check in a forged body to provide full flow in one direction and instantaneous checking in reverse direction. Ball is confined to close limits and can move only in a vertical plane from its seat. Valve body is of high tensile strength aluminum, steel or stainless-steel forgings. All internal parts are stainless steel. Valves are available in  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$ -inch pipe or tube sizes. Operating pressures include: aluminum, 3000 psi; steel and stainless steel, 5000 psi. Pressures indicated incorporate an approximate safety factor of 5 to 1.

Auto-Ponents, Inc., 3001 Grant St., Bellwood, Ill.

## 3 Ways to Slash Fastening Costs with

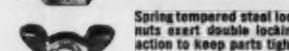
### PALNUT® LOCK NUTS and FASTENERS

#### 1. Save on First Cost

PALNUT Lock Nuts and Fasteners are precision-produced in enormous volume at exceptionally low cost. They are priced lower than other locking methods, often less than plain nuts.



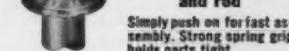
PALNUT LOCK NUTS  
for threaded members



Spring tempered steel lock nuts exert double locking action to keep parts tight.



PUSHNUT® FASTENERS  
for unthreaded studs and rod



Simply push on for fast assembly. Strong spring grip holds parts tight.



PALNUT SELF-THREADING NUTS  
Make their own threads while tightening on unthreaded studs, rod and pins of any malleable material. Save cost of threading—apply fast—hold tight.

Write for latest catalog and free samples, stating type, size and application.

Also consult Sweet's Design File.



**THE PALNUT COMPANY**

DIVISION OF UNITED-CARR FASTENER CORPORATION

18 Glen Road, Mountainside, N. J.

Canada: P. L. Robertson Mfg. Co., Ltd., Milton, Ont.

LOCK NUTS and FASTENERS

Circle 67 on Reader-Service Card for more information



**TYPE B** general purpose relay shown with 2 N.O. and 2 N.C. contacts. Made with up to 8 poles in various arrangements.

**TYPE BX** universal relay shown with 4 poles having both N.O. and N.C. contacts. Additional contacts on the 6 and 8 pole relays are N.O. only.

#### NEW ENCLOSURES

for the Bulletin 700 relays are styled by Brooks Stevens—internationally famous industrial designer. Note the "family" resemblance of these enclosures.

**NEMA Type 1** for general purpose applications with wrap-around cover for ready accessibility. It has a "quality" appearance.

**NEMA Type 4** enclosure for applications that require a watertight and weather-proof seal.

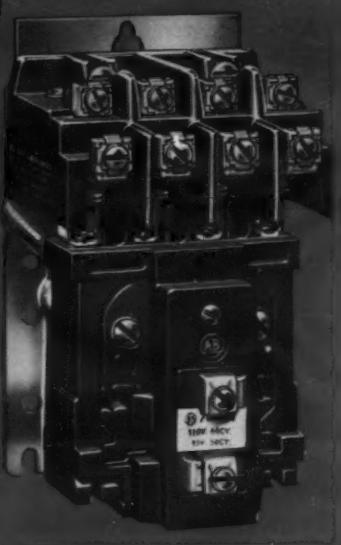
**NEMA Type 7** enclosure for NEC Class 1, Group D hazardous gas locations.



**TYPE BR** Bulletin 700 convertible contact relay shown with four poles. Made with up to six poles in line.

No other relay offers such simplicity in changing contacts from N.O. to N.C. (or vice versa)—it takes only 60 seconds!

A four pole unit provides any of the contact combinations otherwise available only with five relays of the fixed contact type. You can reduce your relay inventories. In tests, this relay has proved it will provide many millions of trouble free operations. Double break, silver contacts never need servicing. Also, each relay can have one or two complete and full rated contacts added to its base—in the field—without increasing space requirements. If you don't know about the Type BR relay, let's get acquainted.



# ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 204 W. Greenfield Ave., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Circle 68 on Reader-Service Card for more information

*Longer Life! Superior Dependability!*

## THE ALLEN-BRADLEY LINE of BULLETIN 700 RELAYS IS COMPLETE!

### THESE IMPROVEMENTS ARE IMPORTANT!

These improved Bulletin 700 Type B and Type BX relays are establishing new standards for relay life and reliability. New design increases mechanical life by *at least 5 times*... a new contact motion insures *at least 10 times* greater electrical reliability. Double break, silver contacts never need maintenance, and the new molded coil is impervious to the most severe atmospheric conditions.

These new A-B relays—with their *extra millions of trouble free operations at no increase in price*—are a bargain in the relay field. Write for complete details, today.

## MECHANICAL

### Torque Motor

319



Functions of this device are: close and hold closed, open and hold open, lift and hold up, tense and hold tensed, press and hold pressed, and pull and keep pulled. Design applications include brakes, cams in conjunction with mechanical linkages, clamping mechanisms, clutches, constant-pressure adjustment, elevator door openers, jigs and fixtures, reeling, slack take-up in winding, and tensioning devices. The unit functions both as a motor and as a solenoid. It is rated by torques (oz-ft, lb-in or lb-ft), and duty specification is based on percent of time motor may safely be installed across line (5, 10, 25, 50 or 100 percent). Overall line ranges from 1.5 to 160 oz-ft. Electrical designs include 110 to 550v a-c, 115 to 130v d-c.

Howell Electric Motors Co., Howell, Mich.

### Anti-Friction Clutch-Brake

320

High-performance clutch-brake drives are useful for most types of industrial machines, special machinery and automation equipment. Clutch and brake are mounted in an integral welded steel housing and operate in a self-contained bath of oil. Clutch can be actuated by any type of three-way pneumatic or hydraulic valve. Brake is spring-operated and is automatically released by mechanical interlocking with clutch. Six different sizes are furnished as either foot or flange-mounted units. Maximum operating speed is 1200 rpm. A sheave, flywheel, sprocket or coupling can be mounted directly on input shaft and a gear, sprocket, cam, eccentric or coupling can be mounted directly on output shaft.

Sommer Associates, 326 N. Western Ave., Chicago, Ill.

**QUALITY  
MOTOR  
CONTROL**

**IT'S A  
FACT**  
YOU CAN DO BETTER WITH  
**DE STA CO**

**CLAMP-ABILITY**



No matter what the size or shape, when you need constant, accurate holding power, the sturdy "clampability" of De-Sta-Co Toggle Clamps is the answer.

More than 25 years of manufacturing experience is reflected in each of over 140 models—from the 1-oz. Tiny Toggle with 50 lbs. holding pressure to the giant 5-lb. model with 2-tons of clamping force.

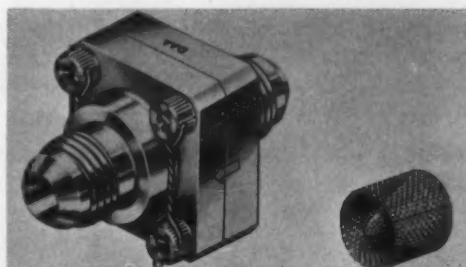
And for the unusual application, our engineers will show you how easily one may be adapted. Inform yourself about De-Sta-Co "CLAMP-ABILITY"...

**FOR MORE FACTS**  
REQUEST  
INFORMATIVE CATALOG  
**YOU CAN**  
**DEPEND ON DE STA CO**  
DETROIT STAMPING COMPANY  
350 MIDLAND AVENUE  
DETROIT 3, MICHIGAN  
DESTA-CO

Circle 69 on Reader-Service Card

DESIGN NEWS—JANUARY 16, 1961

**Miniature Filter Assembly** 321

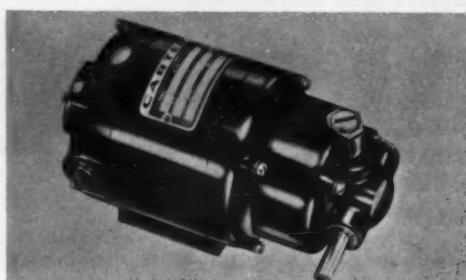


A lightweight miniature filter for fluid-line systems is a small, compact assembly offering universal, in-line applications wherever caustic and/or corrosive liquids or gases are being handled. It has been in service with gases to 2250 psi and will withstand temperature extremes from -350 to 500°F. The device is 1 1/8 inches square and approximately 2 inches overall in length. It is made of stainless steel except for an enclosed, chemically inert "Teflon" washer which seals two halves of body together. Filter element is a woven, wire mesh screen. Design offers maximum flow and provides 1.2 sq in filter surface, of which approximately half is open flow area. The device is manufactured in standard sizes to fit 1/4 and 3/8-inch tube sizes. Other sizes are also available on request.

Dumont Engineering Corp., 1401 Freeman Ave., Long Beach, Calif.

**FHP Gearmotors**

322



Single and double reduction units, in 20 standard sizes, are being offered with shaft outputs ranging from 10 to 750 rpm. Shaft position is easily changed to six 30-deg positions by means of six screws. Motor shaft runs on ball bearings, gear shafts on bronze sleeve bearings. Overall size is 6 by 3 5/16 by 3 3/8 inches. Weight is approximately 5 lb. Available as universal, shunt or series motors, inputs from 12 to 220v are obtainable on most models. Shunt models may be specified up to 115v d.c.

Carter Motor Co., 2700 W. George St., Chicago 18, Ill.

You've never seen a motor like this!



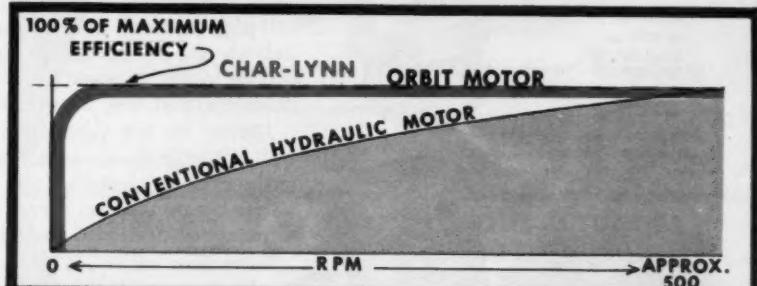
PAT. NO. 2,821,571

**A High Torque, Low Speed Hydraulic Motor**

It's Here—A NEW concept in fluid power mechanics has brought about the development of a totally new fluid motor—A *High Torque—Low Speed* motor.

These motors open up complete new areas for design, never before possible. They offer a practical and

economical hydraulic solution to the age-old problem of providing High Torque at Low Speeds for constant and variable speed drives—hydrostatic transmissions and remote controls without bulky, costly mechanical drives and gear reducers.



Whereas hydraulic losses make some conventional designs prohibitive at the lower speeds, Char-Lynn ORBIT MOTORS maintain high efficiency over the complete operational range.

- Speeds from 0—800 RPM
- Torques to 3300 inch lbs.
- Starting torque substantially equal to running torque
- Fully reversible—instantaneous starting—stopping
- Only 3 moving parts
- 4 types of mountings available
- 3 part sizes—7 power element selections
- Compact—lightweight
- Eliminates costly and complicated power transmissions
- High volumetric and overall efficiency

Write for complete 8 page brochure on ORBIT MOTORS



**HYDRAULIC HORSEPOWER  
PRODUCTS**

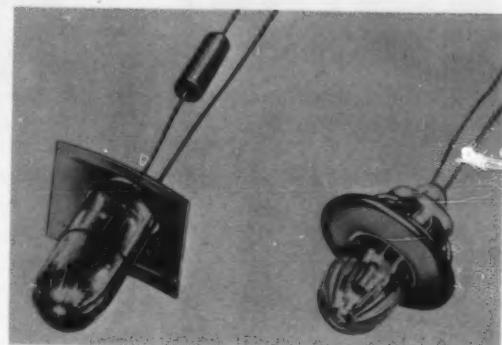
2843 24th Ave. So., Minneapolis, Minn.  
PA 1-5761

Circle 70 on Reader-Service Card for more information

## ELECTRICAL

### Neon Glow Indicators

323



Indicator assemblies are supplied in two styles: with a Timmerman fastener or snap-in plug. Both mount from front of panel; both are available with or without built-in current-limiting resistors. They are manufactured in a choice of three lens styles: plain, fluted or flat cap, and in colorless, red, yellow or white. The high brightness neon glow lamps burn out at the end of useful life, thus units can always be kept at maximum visual effectiveness.

Drake Mfg. Co., 4626 N. Olcott Ave., Chicago 31, Ill.

### Trimming Potentiometers

324



Plastic trimming potentiometers offer good humidity resistance without the use of encapsulation. Specifications of the model 3010 are: resistances, 10 to 100k ohms; maximum operating temperature, 175°C; maximum temperature coefficient, 70 PPM; power rating, 1.0w at 70°C; size, 1 1/4 by 1/4 by 5/16 inch; weight, approximately 0.1 oz. This unit incorporates resistance element termination, a metal-to-metal bond for protection against thermal or mechanical stress. Low temperature coefficient resistance wire and ceramic element card provide good stability over temperature extremes. Two terminal types are available—stranded insulated leads and printed-circuit pins.

Bourns, Inc., 6135 Magnolia Ave., Riverside, Calif.

### ... MICROMETER SETTING

# For Exacting Flow Control

## HANNA Flo-Set® VALVES



### FOR AIR • OIL • WATER • OTHER FLUIDS

Flo-Set 1000

Hydraulic pressure to 1000 psi  
Sizes 1/4", 5/16", 1/2", 3/4"  
Temperatures to 250°F



Flo-Set

Air, Oil, water operation to 250 psi  
Sizes 1/4", 5/16", 1/2", 3/4"  
Temperatures to 250°F



### OTHER HANNA VALVES

Include solenoid, pilot, hand and foot operated types

REGULATING cylinder speeds or controlling fluid flow of air, oil or water is so simple with Hanna Flo-Set Valves . . . you need only turn the valve body one revolution to adjust from zero to full pipe capacity. Micrometer-type graduations are numbered to indicate the percentage of pipe capacity. Once set, the position can be locked to avoid accidental change. Future resetting to a predetermined flow requires no guesswork.

Hanna Flo-Set Valves allow full flow in one direction—controlled flow in the opposite. Used in pairs, they regulate independently cylinder instroke and outstroke speeds. Hanna Flo-Set Valves assure uniform speed, smoother action and improved performance of cushioned and non-cushioned cylinders.

Valve sizes are 1/4", 5/16", 1/2", and 3/4" . . . a 1/4" Jr. model, without graduations or locking collar, is available for light piping and tubing.

Whatever your problem of precision fluid control may be—you will find the best answer in Hanna Flo-Set Valves—designed, built and guaranteed by Hanna's 50 years of experience in hydraulics and pneumatics.

**WRITE FOR LITERATURE AND COMPLETE DETAILS,**  
or consult your classified telephone directory or Thomas' Register for your nearest Hanna representative.

## Hanna Engineering Works



HYDRAULIC AND PNEUMATIC EQUIPMENT CYLINDERS VALVES

1746 Elston Avenue • Chicago 22, Illinois

Circle 71 on Reader-Service Card for more information

## Silicon-Controlled Rectifier

The C50 SCR is a three-junction semiconductor device for use in power control and power switching applications requiring blocking voltages up to 400v and load currents up to 50 amps. Series and parallel circuits may be used for higher power applications. The eight models of the SCR differ by repetitive peak reverse voltage ratings which range from 25 for the C50U to 400v for C50D. Average forward current rating is up to 70 amps maximum a-c rating and 110 amps maximum d-c rating. Typical gate current required to fire the device is 15 millamps at 1.5v, while maximum gate voltage to fire is 3.0v.

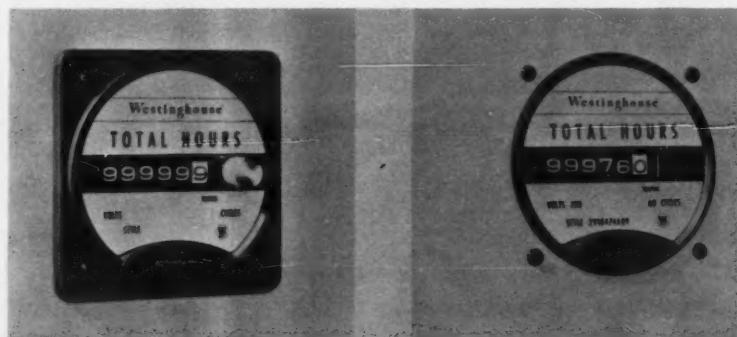
General Electric Co., Semiconductor Products Div., Kelley Bldg., Liverpool, N. Y.

## Elapsed Time Meter

Available with or without reset knob, type BH-351 elapsed time meter can be mounted from either front or back of panel. Since meter indicates total time that a particular circuit is energized, it is suited for such applications as tube replacement programs and maintenance scheduling of electrical equipment, in-

cluding diesel generators, motors, welders, and radio and television transmitters. Six register wheels are provided, giving indication up to 99,999.9 hrs. Digits are white on black background except tenths digit, which is black on white.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.



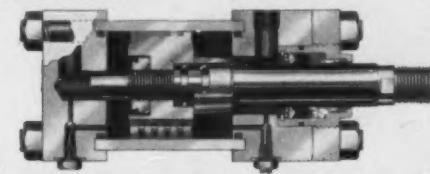
325



326

## EXCLUSIVE WITH CARTER! ROD SCRAPER PLUS ROD WIPER AS STANDARD

J. I. C. Interchangeable SQUARLINE Series features a Metal Rod Scraper plus a Rod Wiper in a quick change Cartridge—Double protection against chips, dirt, damage. Unitized cartridge rod bearing... easy removal and replacement... no cylinder disassembly necessary!

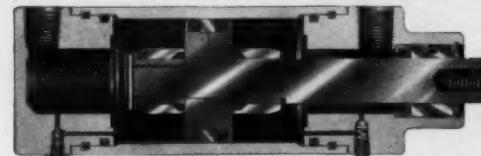


### SQUARLINE 2000-3000 PSI HYDRAULIC

- 1½" to 12" bore
- True cushion-automatic concentric alignment
- 100% JIC interchangeable
- Positive piston locknut design
- Delivery from stock!

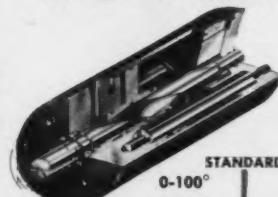
## THE COMPLETE LINE CARTER FLUID POWER

### ROUNDLINE AIR-HYDRAULIC



- Space saving designs! Light weight!
- Full 1 to 1 Meehanite cartridge rod bearing.
- Precision honed heavy wall tubing—6 to 1 safety factor.
- Spring loaded "V" packing on rod end gland.
- Key type stainless steel locking ring. Allows 360° orientation of pipe ports.

### ROTARY TORQUE ACTUATOR PNEUMATIC-HYDRAULIC



- New design opportunities
- To 370° rotation as standard
- Safe, powerful torque
- Air, oil, gas, water operation
- Zero leakage

STANDARD ROTATIONS  
0-100°      0-280°  
0-190°      0-370°

IMMEDIATE DELIVERY ON ALL STANDARD CYLINDERS AND ACTUATORS

### SEND FOR MASTER CATALOG

Complete bound file. Air and hydraulic cylinders, Rotaries, clamp cylinders, air valves, and the new SQUARLINE. Complete details and prices. SEND TODAY.



**CARTER** CONTROLS INCORPORATED

2976 Bernice Road, Lansing, Illinois  
(Chicago Suburb)

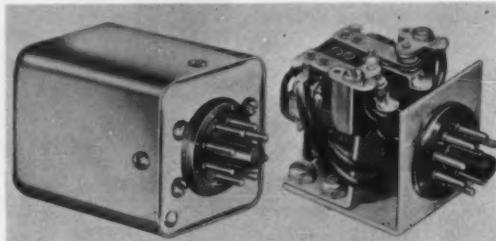
Phone: BAyport 1-7186 (Chicago)  
GGranite 4-3305 (Lansing)  
TELETYPE LNSG, ILL 1119

Circle 72 on Reader-Service Card for more information

## ELECTRICAL

### Plug-In Base Relays

327



Two plug-in base relays with popular (115v a-c) coil rating are now carried in stock for immediate delivery. DPDT contacts of this line are each rated at 15 amps. One of the plug-in models (DOSEPX-5T) is available enclosed in a dust-proof, drawn-aluminum cover. Unenclosed type is designated DOSPX-1T. Plugs on unenclosed and enclosed relays are standard octal types which fit standard octal vacuum-tube sockets. Compact and lightweight, they handle loads usually demanded of much larger relays. They are available in ratings other than those stated for plug-in.

Ohmite Mfg. Co., 3631 Howard St., Skokie, Ill.

### High-Sensitivity Subminiature Switch

328



A sensitive subminiature switch is capable of maintaining a differential travel within 0.001 inch. The switch is designed for temperature or pressure control for military, electronic or instrument applications. Operating force is a maximum  $3\frac{1}{2}$  oz; release force is 1 oz maximum; differential travel is 0.001 inch maximum; overtravel is 0.008 inch minimum and switch has a 0.008-inch minimum break travel. Electrical rating is 30v with 3 amps inductive, 5 amps resistive and 24-amp maximum inrush. UL listing is 5 amps at 125 or 250v a-c.

Micro Switch Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.



## Anaconda takes to the road with ideas for greater values and higher productivity

We're in the market with ideas. Ideas for doing new jobs—like making transistor bases and fluid-cooled conductors. Ideas for doing present jobs better—helping you match the metal to the job more precisely so that you can offer equal or greater value *and* reduce total costs.

These ideas are embodied in Anaconda's line of copper, brass, and bronze mill products, the broadest in the industry—and in the vast pool of experience and technical knowledge of Anaconda men.

To put these ideas to work we've taken to the road with a traveling value-analysis clinic, stopping in industrial centers all over the country. We've a truckload of displays representing our principal products to serve as starting points for discussions of the ideas. We're detaching specialists, technical men, mill men, executives to discuss and explain the ideas with all manufacturers who can attend the clinics.

We're also busy generating new ideas in an aggressive research and develop-

ment program. And we plan to make available soon small, balanced value-analysis teams to go out in the field and work with individual company organizations—make specific suggestions and recommendations regarding materials, fabricating methods, design, etc.

Anaconda is on the move. If you have problems in which you think a new approach might help—call your Anaconda American Brass representative. Or write: Anaconda American Brass Company, Waterbury 20, Conn.

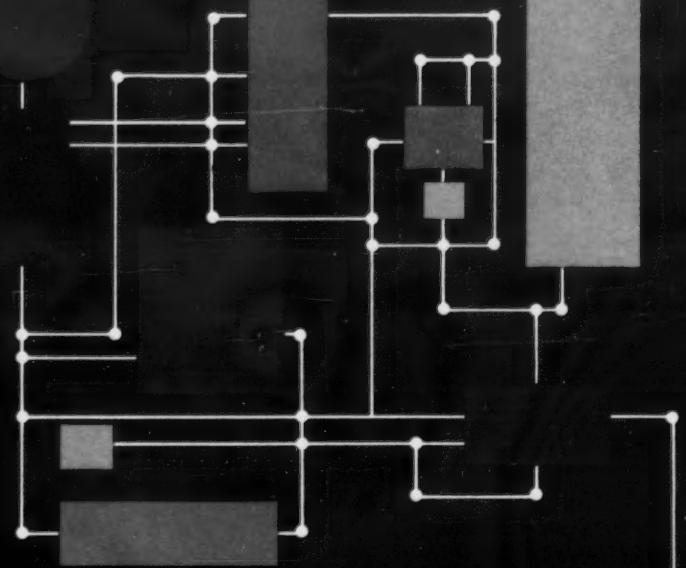


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# ANACONDA®

COPPER—BRASS—BRONZE  
NICKEL SILVER MILL PRODUCTS

Anaconda American Brass Company



**SEARCH**  
is a  
specific  
occupation  
at

**VICKERS**



AERO HYDRAULICS DIVISION

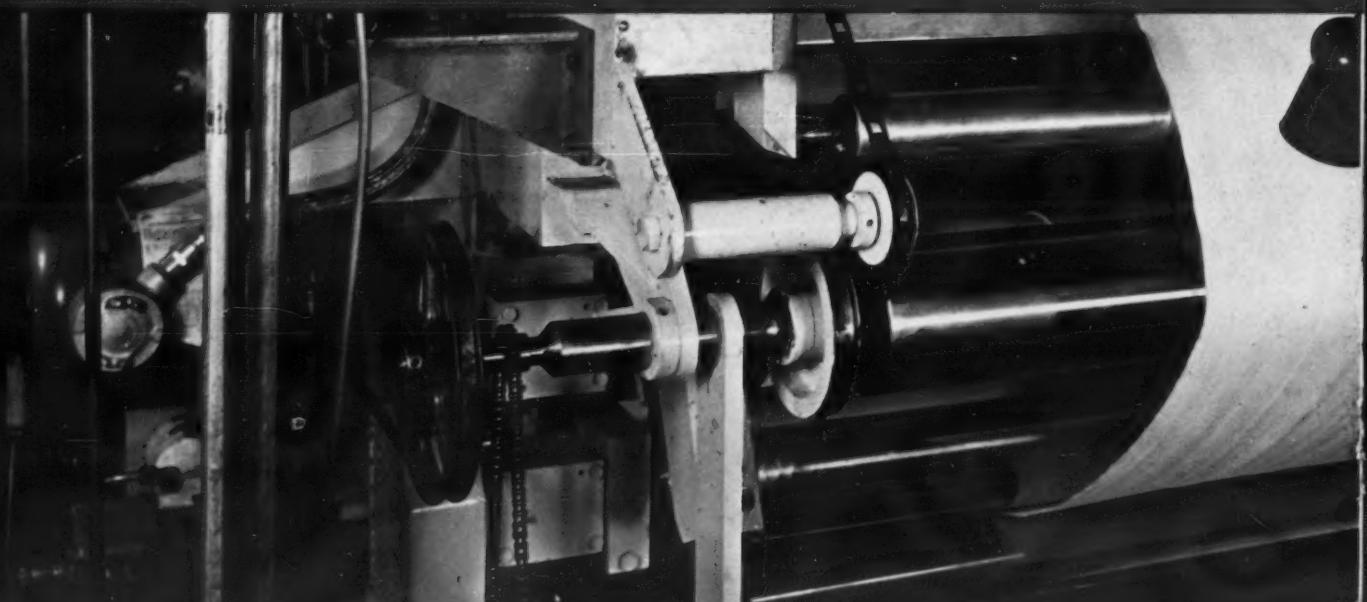
## Reliable main system pumps

Constant improvement in products long recognized as "industry standards" is the story behind the selection of Vickers pumps for all the new American commercial jet airliners. Each Boeing 707, for example, uses two Vickers electrically depressurized variable pumps to operate landing gear, provide flight control boost and power compressors used in engine starting.

Numerous improvements in design, system reliability and contamination tolerance are the results of the latest phase of a continuing program that met the specialized needs of the new higher flying, faster commercial jets.

These pumps are actually the fourth generation of a family that has fulfilled the hydraulic requirements of virtually every American-built transport in the last 20 years.

New materials, components and design modifications are constantly being tested by specialists in these fields to insure performance reliability without equal. Qualification tests far exceed the most rigorous service conditions.



**PACESETTING  
HYDRAULICS**

**like these ...**



**stem only from  
FACILITIES  
LIKE THESE...**





MOBILE HYDRAULICS DIVISION

## New concept in power steering

Maximum maneuverability with finger tip control is an outstanding feature of Caterpillar's new Traxcavator. The ease and precision of power steering means more than operator convenience—it pays off in more material moved every hour on the job.

A completely new concept in power steering, developed by Vickers research and engineering specialists, enables the Traxcavator to get this top performance in a system using standard components. Tailor-made power steering can be provided for vehicles with axle loadings from 1,500 to 128,000 lbs. by combining the right high pres-

sure pump, servo valve, and the required components to each a standard component. All the elements are designed to meet the needs of today's mobile equipment.

Complete system responsibility—offered by Vickers—insures high quality, matched components. Vehicle builders and users alike benefit from centralized responsibility for system design and service. In addition, among hydraulic component manufacturers, only Vickers offers world-wide interchangeability of parts.



MACHINERY HYDRAULICS DIVISION

## "Building block" pre-engineered servo systems

Maintaining constant tension on material during its 80-foot journey through this Inta-Roto plastic laminating machine requires precise synchronization of infeed rolls with the heavier combining rolls. A pre-engineered servo system based on the "building block" concept—made possible by Vickers research—meets these requirements perfectly, providing instant, sensitive, accurate response to changes in tension and speed.

In the "building block" concept Vickers offers standard hydraulic and electrical components pre-engineered into

tested and proved systems—permitting quick installation in specialized engineering costs. Servos are controllable by any of the electronic control means currently available.

Custom designed systems, when required, can be developed from the complete line of Vickers servo components including: servo valves, motors, pumps, transducers and power supplies.

ION

the required cylinders . . .  
All the elements are newly  
of today's more powerful

—offered only by Vickers  
ed components throughout.  
ike benefit from this undi-  
em design, operation and  
ydraulic equipment manu-  
rs worldwide stocks and



## FOR FULL FACTS...

Concept of new, complete power steering systems is discussed in this 18-page brochure that describes basic installations and provides technical component information. Ask for Bulletin M5110.

Name	Title
Company	
Address	
City	Zone State

## FOR FULL FACTS...

Features of electrically depressurized variable pumps and integrated controls are available in a pair of bulletins that include performance curves, weights, dimensions, etc. Ask for Bulletins A-6003.



Name	Title
Company	
Address	
City	Zone State



## FOR FULL FACTS...

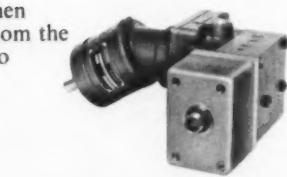
Both electro-hydraulic servo components and pre-engineered "Building Block" systems are described in this bulletin. Operational information on velocity and positional control systems is included. Ask for Bulletin 60-70.

Name	Title
Company	
Address	
City	Zone State

VISION

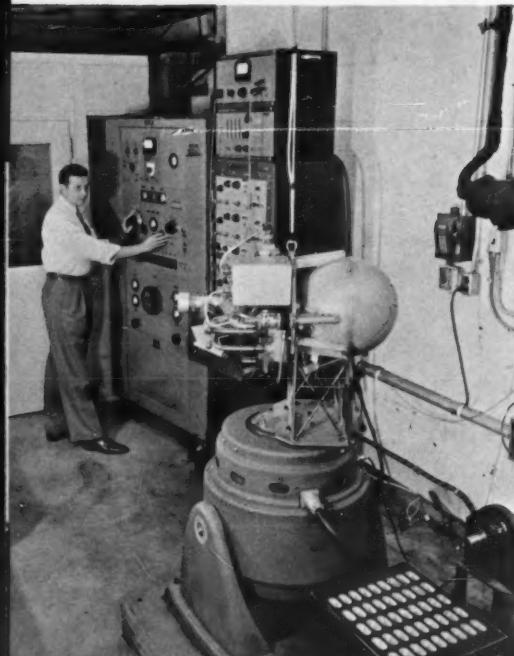
## two systems

permitting a sizable reduc-  
ing costs. These systems are  
electronic programming





Spectrographic analysis is used to determine degree of impurities in semiconductor elements in research facility at Electric Products Division plant in St. Louis.



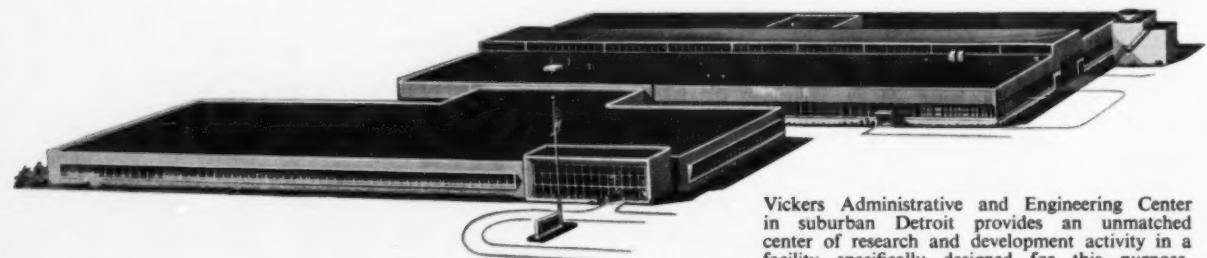
Special test configurations simulate actual operating conditions. Here aircraft electronic cooling equipment is put through its paces.

## Industry's most comprehensive hydraulic research and development program

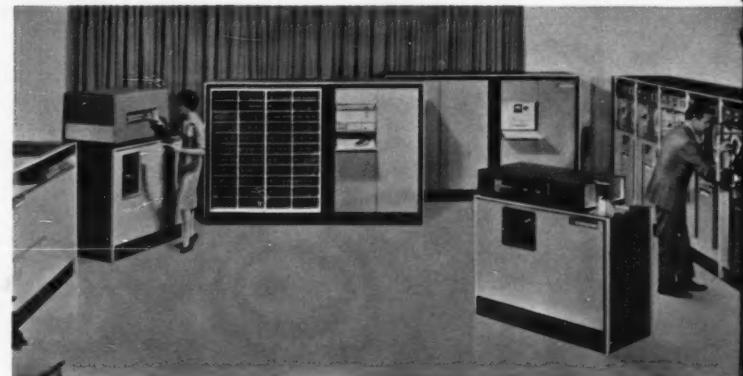
Dedication to research . . . the search for a new and better way . . . is the principle on which Vickers was founded and prospered. Today, that spirit continues in the form of intense research activities on a scale without parallel in the field of hydraulics and related sciences.

At all nine Vickers plants, research activities are carried on as a vital part of each day's business. The heart of Vickers research and development activity is carried on in the Administrative and Engineering Center. Here more than *eight hundred* engineers and technicians apply their skills in surroundings and with facilities designed expressly for this purpose only five years ago. Part of their effort is devoted to the constant improvement of products for the needs of today's customers in industry and defense, and a substantial part of the effort is devoted to creating the future in power transmission, energy conversion, and fluid transfer.

This dedication to constant improvement, to vision, to not accepting the existing simply because it does the job now . . . is your guarantee of products from Vickers which not only meet the need today but also contain a good measure of "tomorrow" as well.



Vickers Administrative and Engineering Center in suburban Detroit provides an unmatched center of research and development activity in a facility specifically designed for this purpose.



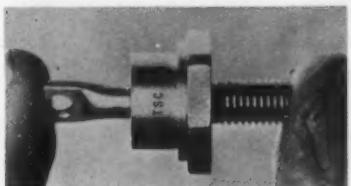
Computers, both the analogue type and the solid state Univac digital type shown, are important tools in advanced planning of new products.

**VICKERS®**

**VICKERS INCORPORATED**  
DIVISION OF SPERRY RAND CORPORATION  
ADMINISTRATIVE AND ENGINEERING CENTER  
DETROIT 32, MICHIGAN, U. S. A.

**20-Amp Silicon Rectifiers**

**329**

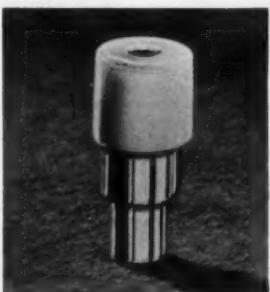


Stud-mounted rectifiers are capable of delivering up to 20 amps at 150C in half-wave circuits. Double-diffused silicon junction units, designed for power rectifier and magamp applications, are designated as series MO. Peak inverse voltage capability of rectifiers in this series is from 50 to 800 PIV. In full-wave circuits, currents up to 60 amps can be obtained.

Trans-Sil Corp., 55 Honeck St., Englewood, N. J.

**Test Jack**

**330**



A short printed-circuit test jack, designed for closer back-to-back mounting of printed boards, is constructed to military material specifications. The jack includes a small-diameter nylon insulator, available in 9 standard colors; a beryllium-copper, spring-pin contact; and a silver and gold-plated contact sleeve for ease in soldering. The device can be mounted closer since length of contact sleeve below printed-circuit board has been reduced. Unit may be mounted by inserting into pre-drilled circuit board hole and connected by dip soldering.

Raytheon Co., Industrial Components Div., 55 Chapel St., Newton 58, Mass.



Circle 75 on Reader-Service Card



Circle 74 on Reader-Service Card

**ROBINSON**  
*Vibration and Shock Control*

**PROTECTS PERFORMANCE and assures  
RELIABILITY in Mobile Installations ...**

**Robinson** was the first to design and produce **all-metal MET-L-FLEX® mounts and mounting systems** for the Army's latest vehicular communications and electronic equipment.

These mounts are designed for virtually every type of military vehicle—including tanks, trucks, jeeps and helicopters, and will be installed wherever greater reliability of vital equipment must be attained and maintained.



Robinson Models W504-5 and W504-7 were designed specifically for the U. S. Army Signal Corps' new AN/VRC-12 radio receiver and transmitter units produced by Avco Electronics and Ordnance Division.

These are the first all-metal mounts to pass the Signal Corps' Ballistic Shock Test (simulating gunfire impact) and the Package Test (simulating repeated road shock). Send for FREE brochure.



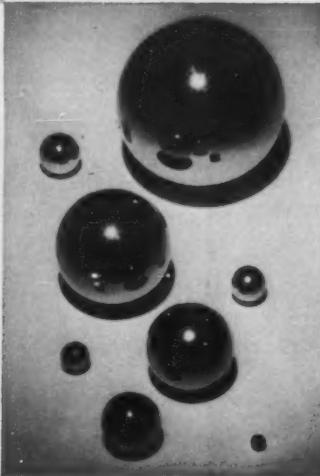
Photos Courtesy of Avco Electronics and Ordnance Division

**ROBINSON** *VIBRASHOCK DIVISION*  
**ROBINSON** *Vibration and Shock Control*  
TETERBORO, NEW JERSEY

West Coast Engineering Office: Santa Monica, Calif.

**DESIGNERS AND MANUFACTURERS OF VIBRATION CONTROL SYSTEMS**

**TOPS IN  
HARDNESS  
AND WEAR  
RESISTANCE:**



## TUNGSTEN CARBIDE BALLS

ITI tungsten carbide balls offer the greatest obtainable resistance to wear, abrasion and deformation. They retain these advantages in many corrosive environments. Other outstanding properties include—

**EXTREME HARDNESS:**  
89 to 91 Rockwell A.

**HIGH COMPRESSIVE STRENGTH:**  
648,000 p.s.i.

**HIGH PRECISION:**

+.0001" size tolerance and .000,020" sphericity are standard. Furnished to +.000,010" on size and .000,010" sphericity if desired.

**EXTRA-SMOOTH FINISH:**  
1 microinch r.m.s.

These balls are available in ALL SIZES, standard and special, from .005" to 5". You can get them from stock in dozens of sizes from 1/64" to 1"; also 1, 5 and 10 mm. WRITE for prices and specifications.



We also make precision balls of all other workable materials, including plastics, sapphire and special alloys—all sizes, standard and special—modified balls—hollow and plated balls—in experimental and mass-production quantities. BULLETIN BU-1 gives details; includes specs on stock balls of 8 materials. Want it? Write, phone or send the inquiry card.

## INDUSTRIAL TECTONICS, INC.

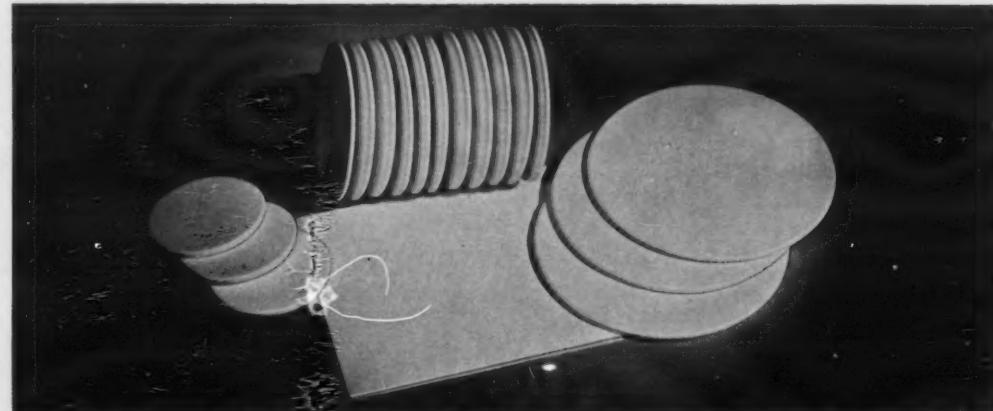
manufacturers of precision balls and bearings

BALL DIVISION | 3686 JACKSON RD., ANN ARBOR 1, MICHIGAN  
Circle 76 on Reader-Service Card for more information

## MATERIALS

### Fuel Cell Ceramics

331



Porous shapes in alumina or magnesia ceramics are available for experimental use in fuel cell research. Sections of membrane material may be modified, within reasonable limits, to specifications of researcher. Ceramics may be fabricated in thin flat sections as desired. Consideration must be given to mechanical strength required for end use. Discs

and plates up to 5 inches in maximum diameter are practical. Larger sizes are obtainable at commensurate cost. Technical assistance is available pertaining to future use of porous ceramics with researchers in this active field.

American Lava Corp., Steatite Div. Laboratory, Chattanooga 5, Tenn.

## Only Crosby-Laughlin hooks say what they do do what they say



**SAFER** — load capacity is permanently forged on every hook... eliminates guesswork, overloading.

**EXTRA CAPACITY** — forged, heat treated, and tested to give you industry's highest guaranteed capacity per size.

**WIDEST LINE** — 1/4 thru 150-ton capacities... all popular shapes and types... carbon steel, alloy steel, or non-sparking bronze.

CL-951

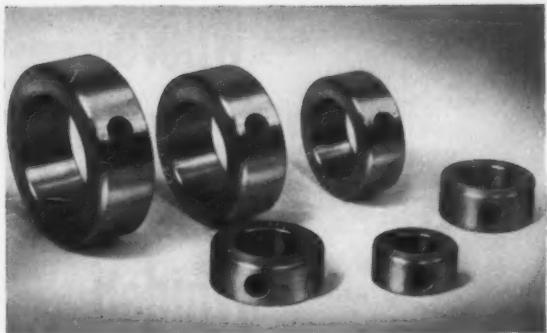


Free catalog gives application data for 2000 types and sizes of forged fittings for wire rope and chain. Ask your distributor for your copy.

**CROSBY LAUGHLIN**  
FT. WAYNE, INDIANA

Division of  
**AMERICAN HOIST**

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## Simplify your design and purchasing with HALLOWELL standard steel collars

- 45 stock sizes— $\frac{1}{16}$  to 3 inch bore
- Immediate delivery from local dealer stocks
- Precision machined from first quality bar stock; perfectly balanced
- Supplied with UNBRAKO knurled cup point socket set screws—famous for their locking reliability
- Every collar size marked for quick identification

For more information, see your authorized industrial distributor. Or write SPS—manufacturer of precision threaded industrial fasteners.

INDUSTRIAL FASTENER Division **SPS**

JENKINTOWN 6, PA.

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The Most Compact Solenoid  
Valve in the Fluid  
Power Control Field...

## VERSA SERIES "A"



Versa's new four-way solenoid valves measure only  $5\frac{1}{2}$ " high by  $1\frac{1}{8}$ " diameter, yet have a full  $3/16$ " diameter flow area. Completely corrosion-resistant and simple to install, Versa Series "A" solenoid valves are available in over 100 different variations. Triple pressure and functionally tested under water for guaranteed leakproofness.

**VERSA**

VERSA PRODUCTS COMPANY INC.  
150 COOLIDGE AVENUE  
ENGLEWOOD, NEW JERSEY



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your free copy of  
Bulletin #1259

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DESIGN NEWS—JANUARY 16, 1961

## Lox Lubricant

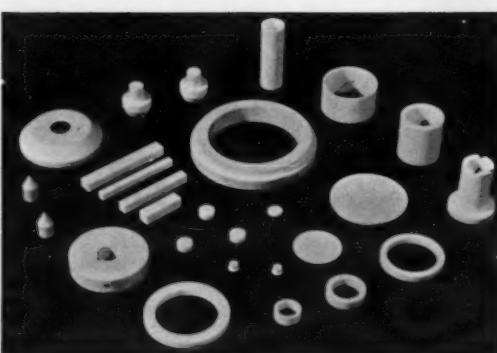
332

A lubricant for rocket propellant systems is compatible with liquid oxygen, does not react adversely when used on aluminum and provides good protection from wear and galling. "Protex Lox-Film" is a blend of dry powders coated with a fluorinated binder and a wetting agent, packaged in a 6-oz pressure can. Sprayed on a surface, the material is said to form a lubricant that does not set or dry and one that is not affected by extremes in temperature. According to the manufacturer, surfaces sprayed with lubricant may be polished if the extremely small particles (under 7 microns) of lubricant provide a hazard to regulators or other components. Additional coats may be added and polished until a dark, high-gloss surface is achieved. Mechanical pressure tends to impregnate the surface with film, increasing bond.

Autolene Lubricants Co., Industrial & Research Div., Denver, Colo.

## Extreme-Temperature Ceramics

333



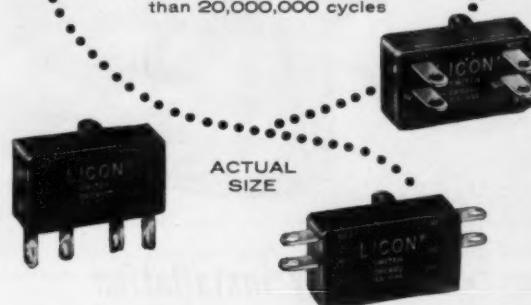
Series HT-1 ceramics, with heat resistance to 3000F, are offered in a range of carbides with dielectric strength as high as 250v per mil. For areas of application requiring a high wear and moderate heat shock, HT-1-A ceramic is recommended. HT-1-B is useful for high heat shock, moderate wear applications. Where moderate heat shock with extreme wear is required, HT-1-C grade ceramic is recommended. Alumina ceramics offer a combination of properties including compressive strengths to 400,000 psi. Parts are available in diameters to 10.00 inches. Standard size tolerances are as close as  $\pm 0.005$  inch as fired, and can be ground to  $\pm 0.0001$  inch. Parts can be metalized for soft or hard soldering, or fastened with ceramic and epoxy cements.

Duramic Products, Inc., 426 Commercial Ave., Palisades Park, N. J.

You've  
never seen a  
**SUB-MINIATURE**  
switch  
as mighty  
as this

BIG switch performance in sub-miniature size

Rated 10 amps 30 V.d-c. Inductive  
(L/R = .026). Consistently more  
than 20,000,000 cycles



**NEW LICON® TYPE 16 SWITCH** measures only  $25/32$ " long and  $1/4$ " thick but packs quality and dependability never before achieved in sub-minis. With characteristics found only in much larger precision switches, the Licon Type 16 is ideal for aircraft safety applications, has performance and size vital to guided missiles. Passes Navy 1300 G shock test . . . exceptionally shock and vibration resistant even near the trip point. Its new switch mechanism with stainless steel springs avoids early fatigue and provides the advantages of double break contacts with wiping action in a wide range of movement differentials and operating forces.



### WRITE FOR FREE LICON CATALOG

Engineering data, characteristics,  
modifications . . . write for new  
catalog with complete information  
on the new Licon broad line,  
featuring the Type 16 Sub-  
miniature Switch.

**LICON**

Switches and Controls

Division of Illinois Tool Works  
6606 West Dakin Street, Chicago 34, Illinois

**i**  
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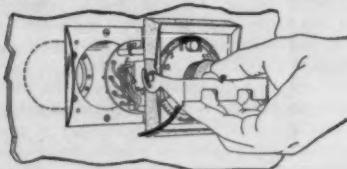
# new plug-in timer for controlling industrial processes

## EAGLE'S HP5 CYCL-FLEX



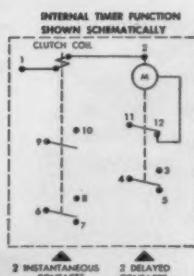
### Offers:

- Fast, easy installation
- Quick change of time ranges
- Quick means of localizing trouble



To Remove: Lift handle and pull out

With 4 switches — 2 switches operate instantly when timer is energized — 2 switches operate with time delay — delay time adjustable — selection of dials from 10 seconds to 60 hours.



For more details on the Cyclo-Flex Timer, write for free Bulletin 125 or contact your local Eagle Representative listed in Thomas Register or Phone Directories in 25 Principal cities.



**EAGLE SIGNAL COMPANY • Moline, Illinois**

A DIVISION OF THE GAMEWELL COMPANY, AN E. W. BLISS COMPANY SUBSIDIARY

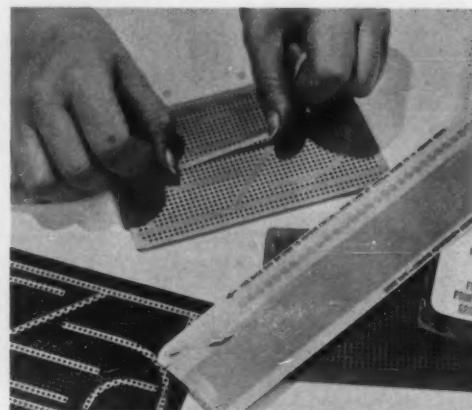
MANUFACTURERS OF THE MOST COMPLETE LINE OF INDUSTRIAL TIME-COUNT CONTROLS

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## MATERIALS

### Circuit Board Pattern Tape

334

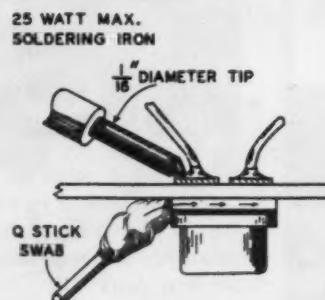


Convenient kits of plastic strips and dots have been developed for laying down circuit patterns on copper-clad printed-circuit grid boards. Strips and dots withstand acid; therefore, when grid boards are dipped in copper-etching solution, only copper that remains consists of desired circuit layout. Tape kits contain 10 strips, 9 by  $\frac{1}{8}$  inch, and 40 dots,  $\frac{3}{16}$  inch.

Corning Glass Works, Corning, N. Y.

### Felt Heat Sink Pads

335



Felt discs pierced with holes for transistor leads are sandwiched between semiconductor and etched circuit board. Felt is injected with a volatile fluid which evaporates during hand solder operations. Evaporating fluid absorbs heat from transistor leads, so that temperature never rises to dangerous levels. Should it be desirable to change a transistor, felt pad is flexible enough to permit one lead to be removed at a time, and fluid again prevents injury to transistor.

Navigation Computer Corp., 1621 Snyder Ave., Philadelphia 45, Pa.

where  
contamination  
must be  
avoided

**SPECIFY  
SPEER**

**ULTRA PURE  
GRAPHITE**

You can eliminate undesirable contamination of many metals and crystals by using crucibles, boats and jigs made of SPEER Ultra Pure Graphite. Parts for electronic tubes and mercury-arc rectifiers may also be improved by the higher degree of purity now offered in this material.

A typical sample of SPEER Ultra Pure Graphite would contain—

B	.26 ppm
Fe	1.0 ppm
V	1.0 ppm

and—especially important in certain usages such as vacuum tubes—would show gas content of .2 to .5 cm<sup>3</sup>/gm. This is less gas than is contained in corresponding unpurified grades.

What is your application? SPEER molded and extruded Ultra Pure Graphite is available in many grades and in sizes ranging to more than 16" diameter. We are also prepared to machine parts and equipment expertly to your own close tolerances. Our engineers will be glad to discuss your specific problems with you.

**SPEER**  
*Carbon Co.*

CARBON PRODUCTS DIVISION  
ST. MARYS, PENNSYLVANIA

Circle 82 on Reader-Service Card

## Fluorine-Containing Thermoplastic

336

"Kynar", a vinylidene fluoride resin designated as RC-2525, is a fluorine-containing thermoplastic designed for long life and high performance in environments which degrade less stable materials. Chemically, the material is a crystalline, high molecular weight polymer of vinylidene fluoride,  $(CH_2-CF_2)_n$ , containing over 59 percent fluorine by weight. Its properties are influenced by stability and inertness characteristic of highly fluorinated molecules. Laboratory tests and functional evaluations of fabricated parts show "Kynar" to be mechanically strong and tough, resistant to distortion and creep at low and high temperatures, highly resistant to the attack of corrosive chemicals, flame resistant, and stable under extreme conditions of weather and ultraviolet radiation. Of primary interest to electrical equipment designers is the use of thin-wall jackets for wire and cable. Thin-wall tubing can be used as sleeving for wire and cable terminals, and as pro-



tective coatings over various electrical components such as resistors. Samples are available.

Pennsalt Chemicals Corp., Research Products Development Dept., P. O. Box 4388, Philadelphia 18, Pa.

## Printed Circuit Ink

337

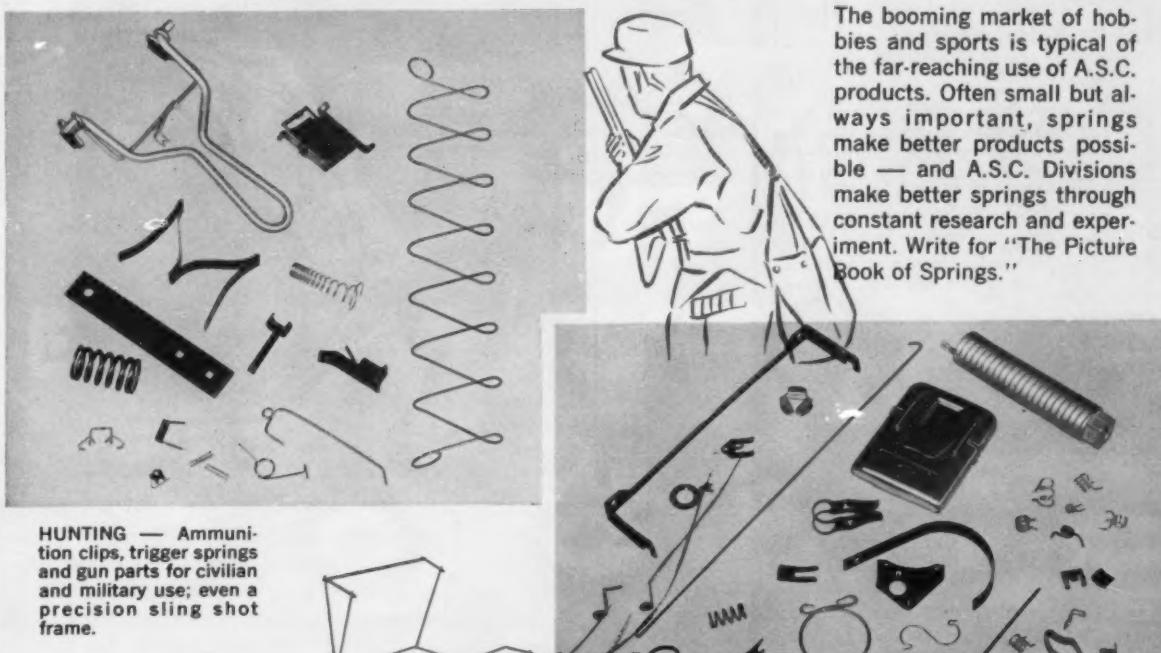
A conductive ink for printed circuits is said to be a smooth, heavy-bodied conductive material that screens sharply and dries in  $\frac{1}{2}$  to  $\frac{3}{4}$  hr. The product is described as a mild solvent-base material of low odor that dries to a tough resistant coating and adheres to a wide variety of materials. When deposited by screen process through an 8xx mesh, a conductivity rating of 3000 to 5000 ohms per inch can be anticipated. Item No. R-284-V is available in pint, quart or gallon containers.

Advance Process Supply Co., Inc., 2315 W. Huron St., Chicago 12, Ill.

# From Hunting to Hi-Fi . . .

## There's a Spring in your Hobby

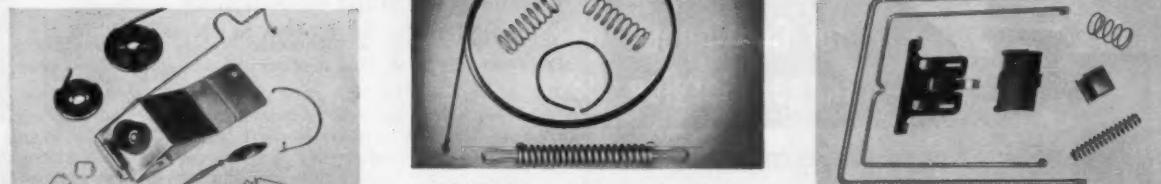
The booming market of hobbies and sports is typical of the far-reaching use of A.S.C. products. Often small but always important, springs make better products possible — and A.S.C. Divisions make better springs through constant research and experiment. Write for "The Picture Book of Springs."



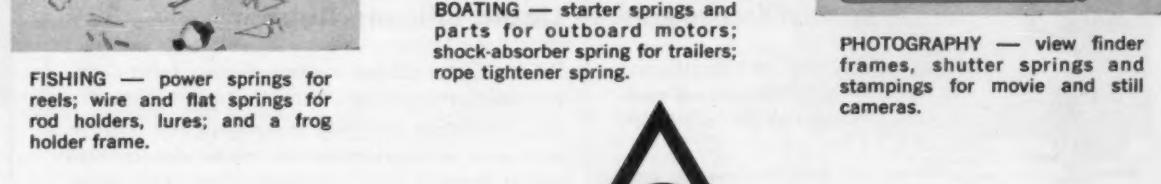
HUNTING — Ammunition clips, trigger springs and gun parts for civilian and military use; even a precision sling shot frame.



MUSIC — Coils and clips for radio, TV and record players; violin mute springs, guitar levers, springs for cornets, pianos, organs.



BOATING — starter springs and parts for outboard motors; shock-absorber spring for trailers; rope tightener spring.



PHOTOGRAPHY — view finder frames, shutter springs and stampings for movie and still cameras.

## Associated Spring Corporation

Wallace Barnes Division, Bristol, Conn. and Syracuse, N.Y.

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Ohio Division, Dayton, Ohio

F. N. Manross and Sons Division, Bristol, Conn.

San Francisco Sales Office, Saratoga, Calif.

General Offices: Bristol, Connecticut

William D. Gibson Division, Chicago 14, Ill.

Milwaukee Division, Milwaukee, Wis.

Dunbar Brothers Division, Bristol, Conn.

Wallace Barnes Steel Division, Bristol, Conn.



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MAYLINE



### Keep Your Drawings Flat and Clean

METAL PLAN FILE

Mayline metal plan files have hinged dust covers that stay in upright position when drawings are being removed or inserted in drawer—leaves both hands free. Drawers operate freely on muted ball bearing rollers.

For space saving economy Mayline Plan files can be attached to the 4-Post or the May-O-Matic tables. Metal and wood plan files described in folder S-20. Your local dealer has this information for you.

MAYLINE

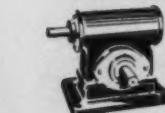


WOOD PLAN FILE

MAYLINE

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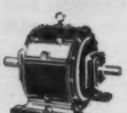
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**SPEED REDUCERS**



Designed and Constructed for Continuous Rugged Service



trouble-free, economical drives for any speed reduction need



Compact, precision built Abart units are available in a wide range of models from fractional to 168 hp. ratings, ratios to 10,000 to 1.

Worm, spur and combination gear models—single or double reduction—are supplied in 75 different types and sizes with any desired shaft arrangement.

Write today for Abart's hand pocket size speed reducer catalog.



**ABART GEAR and MACHINE CO.**

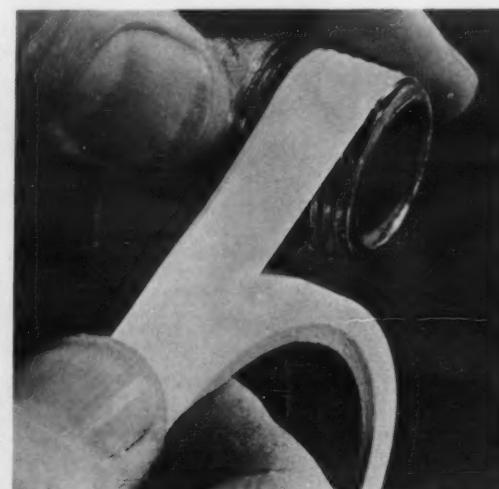
4830 WEST 16th STREET • CHICAGO 50, ILLINOIS

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## MATERIALS

### Pipe Dope Tape

338



Useful in industrial applications for making up threaded joints in all types of pipe, "Pipe-Pac" offers a fast, economical method of getting clean, tight, permanent couplings. Recommended for joining metal, plastic, ceramic, rubber and other pipe materials, the tape will withstand temperatures from -300 to 500°F. It can be used for pipe carrying air, oil, water, gas, steam, solvents and chemicals of most types, and also corrosive materials. Tape will not cake or harden and will prevent freezing of a joint and allow easy disassembly when needed for maintenance. Pocket-sized pack is available in 240 and 480-inch rolls.

Johns-Manville, 22 E. 40th St., New York 16, N. Y.

### Liquid Silicone Rubber

339

RTV silicone rubber in aerosol spray form shows promise for applying a thin, uniform encapsulating coating on electronic assemblies and parts as well as a spray coating for release for molded plastic parts. The RTV material has good physical and electrical properties and is resistant to temperatures from -65 to 600°F. It is resistant to many solvents and is unaffected by ozone, has its own "built-in" release agent, and exhibits good bonding ability. Cure time varies from 15 minutes to several hours, depending on amount and type catalyst used.

General Electric Co., Silicone Products Dept., Waterford, N. Y.

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*Specify!*  
THE BEST!

A half century of experience is back of every instrument we make. You get assured accuracy and long dependable performance when you specify "Philadelphia." Our specialized staff will be glad to discuss your problem in our field.

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Since 1905

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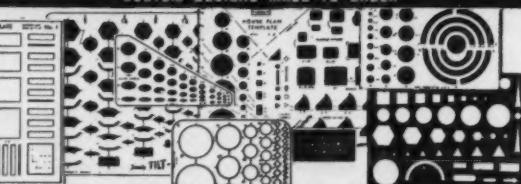
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- Designing Aids
- Measuring Devices

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**Pressure-Sensitive  
Tape** **340**

This fire-retardant, pressure-sensitive, polyurethane foam tape conforms to military specifications including M-R-0020092C (Ships). In accordance with the "Hot Bolt" test described in this specification, a red-hot bolt is allowed to burn a hole through a  $\frac{1}{4}$ -inch thick pad of foam adhered to metal. Within seconds after bolt is removed, flame is extinguished. This material offers the advantages of polyurethane for cushioning, insulating, gasketing, and as a light, vapor and dust barrier, with additional advantage of being self-extinguishing when primary source of flame is removed. Samples are available upon request.

Richards, Parents & Murray, Inc., 312 Seventh Ave., New York 1, N. Y.

**Protective  
Sealants** **341**

Selective placement and positive adherence of sealants in any elastomeric material is possible in most any shape, form, size or dimension on a productive part, and can be applied by mass-production method, eliminating after-assembly sealing and providing a good seal. The sealing material can be applied in almost any position, shape or form on metal stampings, plastic parts, nuts and nut washer assemblies, wire forms, washers, bolts, screws, rivets, studs, clips, clamps, and other fasteners. Problems caused by water, moisture, dirt, dust, fumes, gases and chemicals, or those caused by sound, vibration, odor, corrosion and deterioration can be controlled.

Automotive Rubber Co., 12550 Beach Rd., Detroit 39, Mich.



Circle 88 on Reader-Service Card

# **STOP MOTOR BURNOUT**

## **ASCO Close-Differential Relays provide dependable, low-cost protection from under and over voltage.**

When a motor runs on low voltage for an extended period of time, burnout and fire may result. This can be costly in both down-time and damage to equipment.

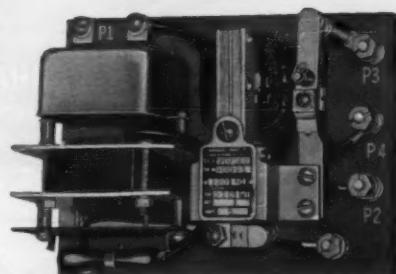
You can protect your motors with ASCO Close-Differential Relays. They offer economical, dependable protection even when motor feedback conditions prevent ordinary potential relays from detecting changes in voltage. ASCO Close-Differential Relays respond to a 2% variation in voltage; protect motors when low voltage or over voltage conditions occur.

Because they combine sensitivity with rugged construction, ASCO Relays are providing low-cost protection in a wide variety of applications.

For example, in some oil burner installations, ASCO Relays help prevent explosions due to under voltage. In these installations, when under voltage occurs, ASCO Relays prevent oil build-up in the pit by detecting this low voltage condition, and causing oil flow to be cut off immediately. Otherwise on under voltage the oil would build-up in the pit since the ignition system would not fire. This excess oil could result in an explosion when voltage is restored and the ignition system fires.

Find out how the ASCO Close-Differential Relay can protect your equipment. Send for Catalog 57-S4 describing the complete line of ASCO Relays.

*Dependable control by ASCO is available from representatives and distributors in all principal cities.*



ASCO Close-Differential A-C Relay operates on 2% variation in voltage—features positive action, quiet operation, power relay type contacts.

## **ASCO Electromagnetic Control**

Automatic Switch Co. 56D HANOVER RD., FLORHAM PARK, N. J., FRONTIER 7-4600

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

**ASCO**

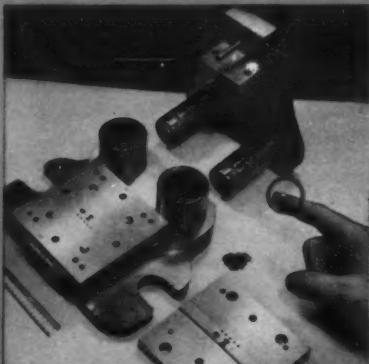


NOBODY SAID "It Couldn't Be Done"  
BUT ONLY LEMPCO 2 POST STOCK\* DIE SETS COULD DO IT!

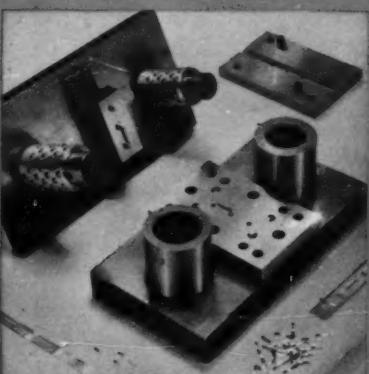
To the best of our knowledge, Lempco is the only 2-post STOCK\* die set which could produce this electronics part from .001" thick high nickel alloy material—with punched holes of .001" diameter. This die, mounted in a standard Lempco STOCK\* die set, produced 30,000 burr-free parts on its initial run.

Users everywhere have found that a STOCK\* Lempco 2-post die set will out-produce special 4-post "friction type" sets—at a fraction of the cost. You can prove this to yourself!

\*Off-the-shelf DELIVERY, with warehouse stocks in all major metalworking areas of the U.S.A.



MATERIAL: .001" Thick, High Nickel Alloy  
Punched Holes, .001" Diameter



WRITE OR PHONE US TODAY  
FOR FURTHER INFORMATION.

Diebuilder: Varco Machine & Tool, Pittsburgh

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MATERIALS

Braided Shielding

342

Flat braid, oval commercial braid, and tubular braid to military specification QQ-B-575, are all available for immediate delivery. Because of the high conductivity of flat braid, it is capable of carrying large amounts of current at low voltages, while its flexibility permits it to be used in confined areas or as an electrical connection on moving parts. It may also be used as a bonding strap in vehicles and aircraft to help eliminate ignition interference. Oval braid is useful as an electrostatic shield for insulated cables or other conductors and its shape allows it to slip easily over



any number of components without difficulty. Tubular braid is made with internal supports which keep it circular in cross-section. This braid is called for in military specifications requiring maximum shielding against electrostatic interference. It is also used as a protective covering against mechanical abrasion and stresses for the wire, cable and other components which it covers.

Alpha Wire Corp., 200 Varick St., New York,  
N. Y.

**DURA SEAL**

THE  
ENGINEERED MECHANICAL SEAL

... spells out the  
answer to your  
sealing problems

**D**ecreases maintenance expense

**U**naffected by corrosives

**R**otates with the shaft

**A**djusts itself automatically

**S**eals abrasive liquids

**E**liminates scoring of shafts

**A**daptable to standard stuffing boxes

**L**essens power costs

For free engineering counsel on  
your sealing problems ... write

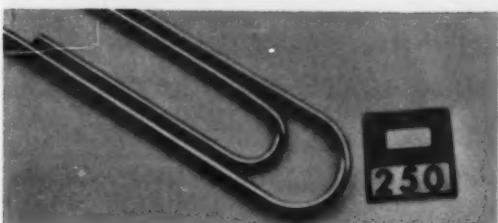


**DURAMETALLIC CORPORATION**  
KALAMAZOO, MICHIGAN

Circle 90 on Reader-Service Card

**Temp Indicating Label**

343

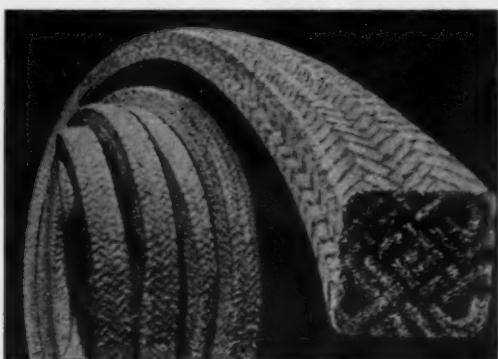


Measuring only  $\frac{1}{4}$  inch square, overall size, model 200 Temp-Plate is useful for instrumenting transistors and other miniature electronic components, inaccessible machinery areas and general industrial or aviation equipment. The hermetically sealed label, a tiny plastic adhesive tab that sticks on almost any surface, turns black when its temperature reaches any desired value between 100 and 500°F. Accuracy is  $\pm 1$  percent. Easy to use, the temperature indicator is impervious to most shop and flight line or launching area atmospheres. It provides a record of alarm-limit temperature, shows at a glance whether a part is operable or unsafe.

Pyrodyne, Inc., 11973 San Vicente Blvd., Los Angeles 49, Calif.

**'Teflon' Braided Packing**

344



Designated style 5875, this white asbestos braided packing contains more than 30 percent "Teflon" by actual weight. This type has wide application on rotary and centrifugal shafts, valve stems and expansion joints, and reciprocating rods, plungers and rams. It has a temperature range from -90 to 500°F and its low coefficient of friction reduces wear to packing and to mechanical components during start-up and operation. It remains unaffected by moderately destructive and corrosive minerals acids and caustics. Packing is offered in  $\frac{1}{4}$  through  $\frac{5}{8}$ -inch sizes in 1/16-inch increments, in either spool, reel or ring form.

Garlock Inc., 457 Main St., Palmyra, N. Y.

# BLOOD BROTHERS UNIVERSAL JOINT

## **SOLVES ANOTHER POWER TRANSMISSION PROBLEM!**



Working with a major manufacturer of truck axles, Rockwell-Standard engineers developed a new design for a front steering, driving axle that uses a single carden universal joint in place of the expensive and complicated constant velocity type previously used on a special all-wheel-drive vehicle.

**The result:** An axle that provides substantially increased torque capacity . . . at a considerable savings in manufacturing costs!

Whether you are designing a new product or seeking to improve an existing one, consult Rockwell-Standard engineers for specialized help in meeting your universal joint needs. Chances are, a Blood Brothers product will not only increase performance — but save you time and money as well.

**For further product information write for Bulletin**

*Another Product of...*

**ROCKWELL-STANDARD**  
CORPORATION



Universal Joint Division, Allegan, Michigan

Circle 91 on Reader-Service Card for more information

## NEWS FROM THE ORIGINATORS OF METAL-SEAL FITTINGS

the 'CN' metal-seal  
tube fitting **SEALS**  
**ALL** straight-thread ports

Seal ALL Straight-Thread Port Designs—  
There's no change in the ability of 'CN' fittings  
to seal perfectly the S.A.E. port design, as well  
as the UN port design (the ultimate port for  
both O-ring and metal seal fittings).

Captive nut wedges the metal seal ring  
into port angle. Resulting seal is unaffected  
by vibration, exotic fluids, high temperatures.  
Seal can be remade repeatedly.

**Write for "Leak-Proof Port Connections"**

"SPECIALISTS IN HYDRAULIC FITTINGS"

**L and L Manufacturing Company**

21590 Hoover Road • Warren, Michigan

DISTRIBUTORS IN PRINCIPAL CITIES

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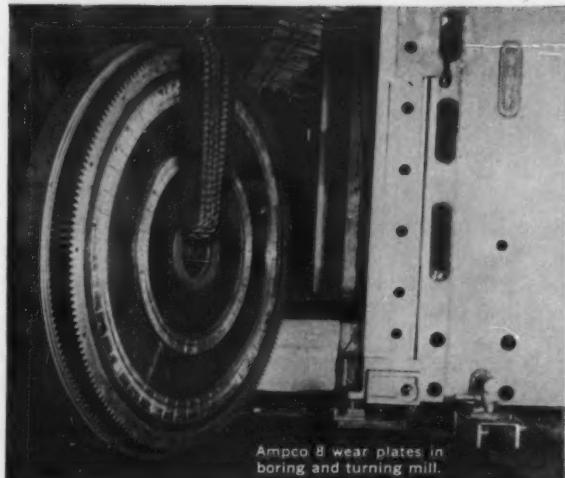


## MATERIALS

### Silicone Rubber Cement 345

An adhesive system for bonding silicone rubber to itself or silicone rubber to glass, "Dacron" and nylon fabrics shows bond strengths varying from 8 to 15 psi peel strength. Peel strength depends upon formulation of silicone rubber to be cemented. Adhesive may be used for bonding silicone rubber to metal, plastic and ceramics with aid of "COHRLastic" C-260 Metal Primer. Cement has an effective temperature range from -100 to 500F. The material cures under heat and pressure to form a tough yet flexible bond.

Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.



Ampco 8 wear plates in  
boring and turning mill.

**EXTEND SERVICE LIFE...USE AMPCO 8**  
for ways, slides, gibes, guides, wear plates and strips. The special structure of Ampco 8 withstands high working pressures and shock — resists abrasion, erosion, corrosion, and cavitation-pitting. For extremely severe wear and abrasion, Ampco 18 and 21 rectangles are available. Let your Ampco distributor recommend the grade and form suitable for your application. Write for his name — and Bulletin G-50.

D-85



**AMPCO METAL, INC.**  
Dept. 44A, Milwaukee 1, Wis.  
Huntington Park, Calif. • Garland, Texas

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**Hobbs DUAL CIRCUIT PRESSURE SWITCHES**

**Add a NEW DIMENSION to Pressure Activation!**

**A COMPLETE LINE OF PRESSURE SWITCHES**  
Also available — a wide selection of single circuit pressure switches. Built by the manufacturers of Hobbs Running Time Meters and Shock-Mounted Head Lights. Distributors in principal cities . . . Write for CATALOG PS605

**Symbol of SW Excellence**

**John W. Hobbs Corporation**  
A DIVISION OF STEWART-WARNER CORPORATION  
2000 YALE BLVD., SPRINGFIELD, ILLINOIS

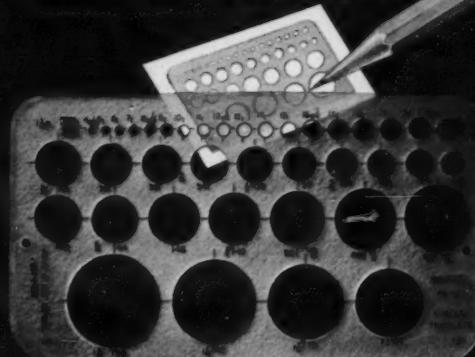
Circle 93 on Reader-Service Card for more information

### Sealing Compound 346

"Led-Plate No. 250" is available in small containers designed to accompany products for assembly of threaded fittings or gaskets. A 1/4-oz to 50-lb pail assures a safe, secure and economical assembly compound for any threaded unit. The material meets specifications MIL-A-907B (Q.P.L. 907), industrial specifications for hydraulic fluids (100,000 psi), steam, air, gases, water and chemicals. The compound is corrosion-resistant and is recommended for highest of thread temperatures (-350 to 2987 F). Samples are available.

Armit Laboratories, 6609 Broad St., Los Angeles 1, Calif.

### Another Arm-The NO. 40 CIRCLE TEMPLATE



\$1.00 AT YOUR LOCAL DEALER

030 MATTE FINISH MATHEMATICAL QUALITY DOUBLE-CURED PLASTIC.  
ALL HOLES SMOOTH-MILLED TO ENGRAVING MACHINE ACCURACY.

ONE OF MORE THAN 30 RAPIDESIGN TIME-SAVER TEMPLATES—ALL  
OF WHICH ARE BETTER MADE, MORE USEFUL AND LESSER PRICED.

CATALOGUE NO. 49 AVAILABLE UPON REQUEST

**RAPIDESIGN INC.**

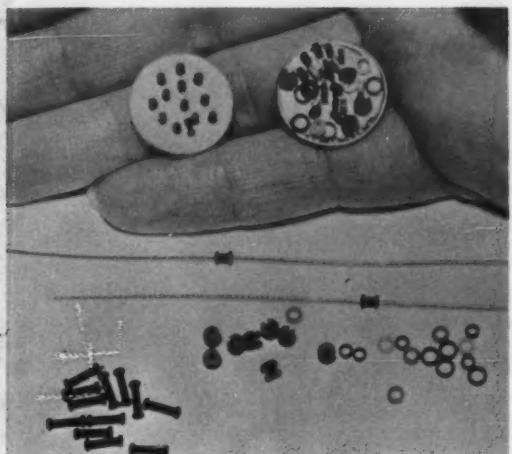
P. O. BOX 392 GLendale, CALIF.

Circle 95 on Reader-Service Card for more information

DESIGN NEWS—JANUARY 16, 1961

## Microminiature Epoxy Parts

347



Miniature and microminiature resistor bobbins, coil forms and encapsulating cups offer high electrical, mechanical and chemical properties. Parts are mass-produced with high accuracy and uniformity in sizes as small as 1/32 inch OD and 1/32 inch in length, to wall thicknesses of 0.004 inch. Special cup assemblies can be designed for chokes, coils, transformers, filters, semi-conductors and modules.

Hysol Corp., Hysol of Calif. Div., 1706 Potrero, South El Monte, Calif.

## Polyester Resin Plastic Filler

348

Called "Magic Bond", this plastic filler and cream hardener is said to adhere to metal, wood, plastic and other materials. It will not rust, corrode, shrink, flake, chip or peel. Also it is flexible enough to withstand heavy vibration without loosening or cracking. The filler works like putty and hardens in 5 to 7 minutes at room temperature. After 15 to 20 minutes, it can be sanded to a smooth feather edge and painted. It is non-toxic and contains no fiberglass.

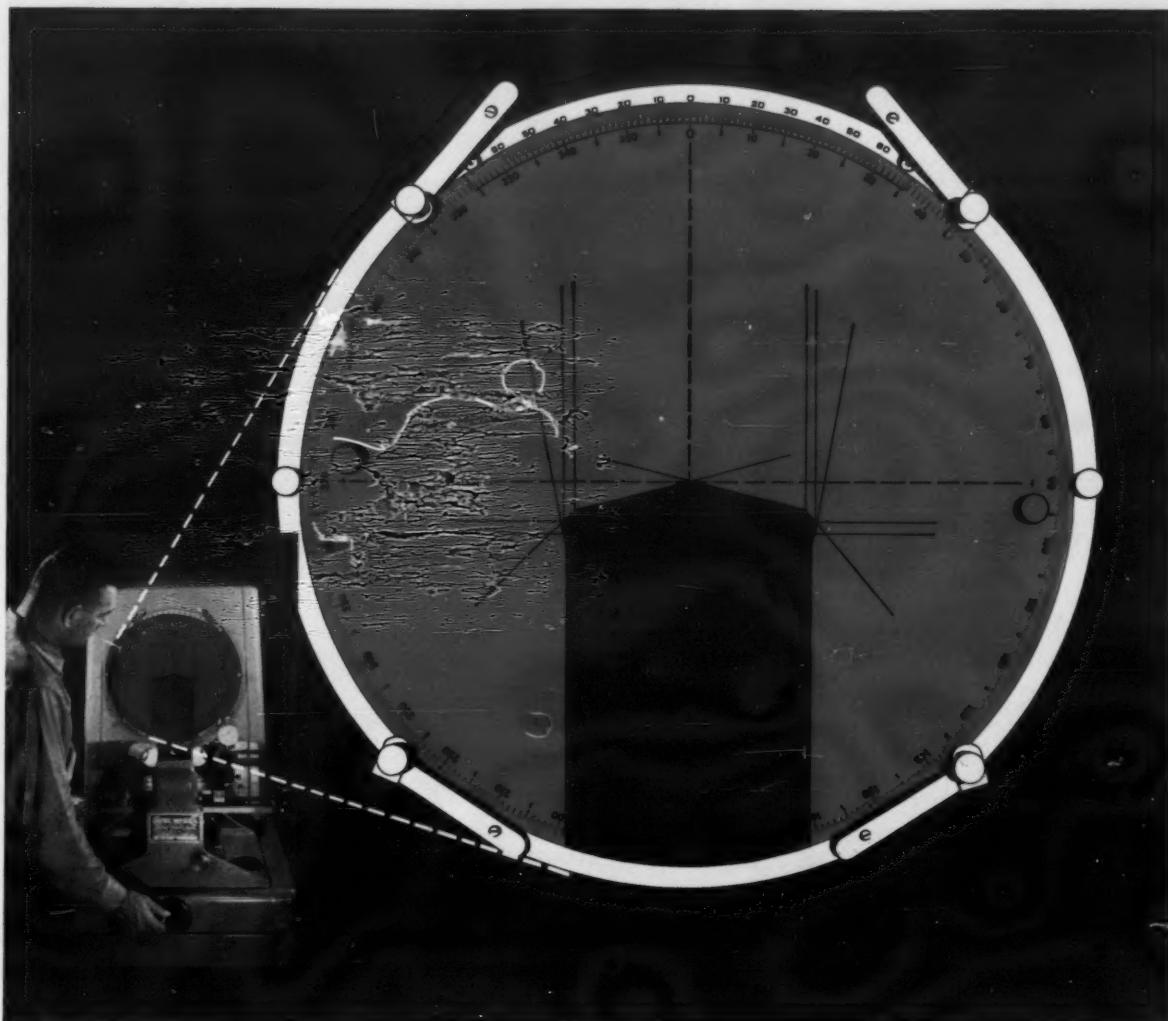
Magic Iron Cement Co., Inc., 14215 Caine Ave., Cleveland 28, Ohio.

## Vinyl Latex Paste

349

"Kex" paste spackling is packaged in a convenient 1/4-pint poly tube for easy one-hand operation. The white material is used for patching cracks and nicks in plaster, wood and wallboard.

Bradley Sun, Div. of American Can Co., Hillside, N. J.



## EVERY RICHARD BROTHERS PRODUCT IS COMPLETELY INSPECTED FOR ACCURACY AND QUALITY

Whether it be punches, dies or related tools, every Richard Brothers product is inspected to conform to our exacting standards and to fulfill our customers' requirements.

Quality-control facilities, precision inspection tools and equipment are used to assure that no flaw escapes detection, every specification is met.

It's your assurance of Richard Brothers reliability — it's your guarantee of interchangeability.

That's one of many reasons why it pays to specify Richard Brothers products for all your metal-piercing needs.



QUALITY



RELIABILITY



INTERCHANGEABILITY



COMPLETE STOCK

## RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION  
26500 CAPITOL AVENUE • DETROIT 39, MICHIGAN

Circle 96 on Reader-Service Card for more information

## EQUIPMENT



**Said Gaspard de Coriolis:** "A particle which is subject to no forces in a rotating coordinate system experiences a radial acceleration and a tangential acceleration."

It was around 1840 that Coriolis discovered what has since become known as the Coriolis Effect. He noticed objects above the earth tend to rotate relative to the earth's rotation . . . to the right in the northern hemisphere, to the left in the southern.

The Coriolis Effect is in force in outer space, too. If a space vehicle is rotated in order to establish artificial gravity, the necessarily short radius of the rotation causes a Coriolis force. This creates orientation problems for a human occupant. To eliminate this difficulty, a scientist at Lockheed Missiles and Space Division conceived the idea of connecting the vehicle to an auxiliary fuel tank by a half-mile-long cable. Thus, if the whole system is then rotated at a reduced speed around its center of mass gravity, the longer radius greatly minimizes the Coriolis force. Right now—on the drawing boards a Lockheed—is an enormously advanced space vehicle system which utilizes this concept, in addition to many others.

Fortunately, natural laws are about the only restrictions which circumscribe scientists and engineers at Lockheed Missiles and Space Division. The climate in Sunnyvale and Palo Alto, on the San Francisco Peninsula, is close to perfection. The creative atmosphere—the opportunity to work on such important projects as the DISCOVERER, MIDAS and SAMOS satellites, the POLARIS FBM, or even more advanced concepts such as the space system cited above—is the dream of the creative engineer.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-11B, 962 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required.

### **Lockheed / MISSILES AND SPACE DIVISION**

Systems Manager for the Navy POLARIS FBM; the Air Force AGENA Satellite in the DISCOVERER, MIDAS and SAMOS Programs

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HAWAII

### **Aluminum-Edge Drawing Boards**

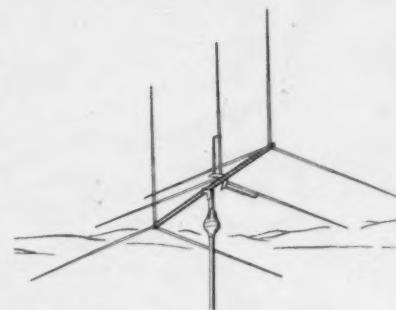
**350**



Artists and draftsmen will find the 710-M series drawing boards useful for greater accuracy in drawing with T-square. The aluminum edges also increase resistance to warping. Units are available in 5 sizes: 12 by 17, 16 by 21, 18 by 24, 20 by 26 and 23 by 31 inches.

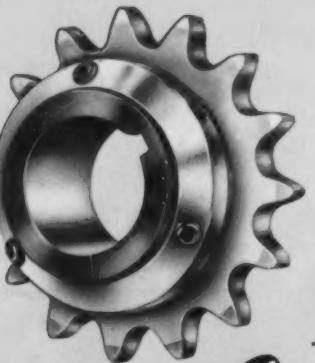
ANCO Wood Specialties, Inc., Glendale 27, L. I., N. Y.

### **Citizens' Band Antenna 351**



If you employ citizens' band radio in the operation of your business or for personal communications, this unit will give efficient operation with your installation. The manufacturer states that the device will radiate a pattern effective to both ground plane (automobile antenna) or horizontal beam (fixed installation). It provides high gain needed for efficient range between mobile, office or home stations. A switch changes beam to horizontal or vertical.

Marina Communications, 10328 Venice Blvd., Culver City, Calif.



*all steel =  
all set to go!*

## Cullman Grip-Master Sprockets

Simple, compact, strong... featuring interchangeable sprockets, hubs and bushings—GRIP-MASTER SPROCKETS are ready to use in convenient "off the shelf" sizes and styles... the only all-steel constructed sprockets with standard bores, key-

ways and set screws. Sprockets up to 7" diameter have hardened teeth for longer wear. Easy installation and removal. Better investigate GRIP-MASTER today.

Remember Standard Cullman Sprockets and Roller Chains—also Flexible Couplings... always available.

FACTORY  
WAREHOUSES }  
AT

821 South Santa Fe Avenue,  
Los Angeles 21, California  
2618 Carnegie Avenue, Cleveland 15, Ohio  
205 North 11th Street, Tampa 2, Florida

**WRITE** today for free information and literature.

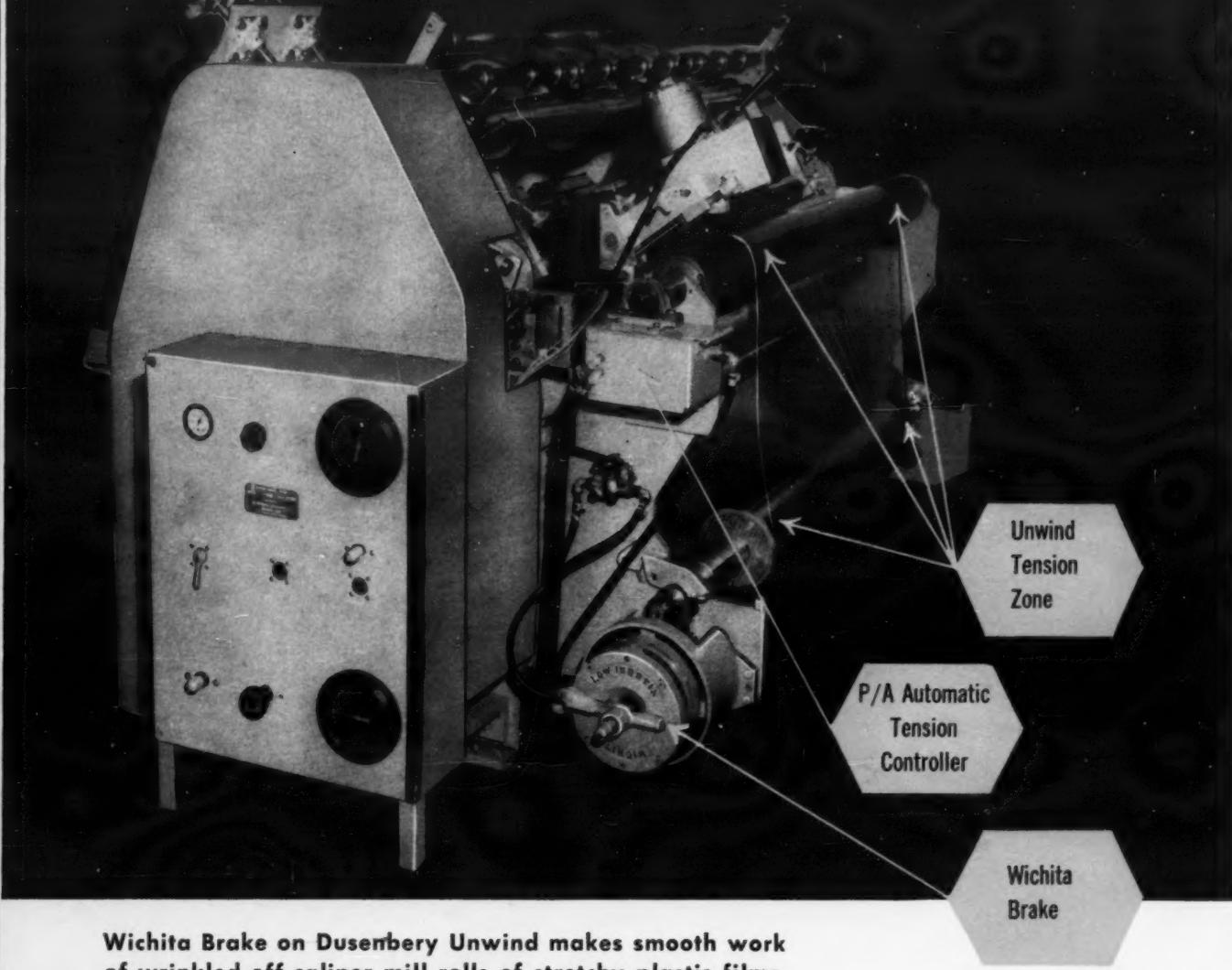
**cullman**  
**wheel** COMPANY

1344 Altgeld Street • Chicago 14, Illinois • BUckingham 1-2800

*Roller Chain Drives Since 1893*



# CONTROL



**Wichita Brake on Dusenberry Unwind makes smooth work of wrinkled off-caliper mill rolls of stretchy plastic films.**

Where tension control is a *must*, in unwinding, slitting and rewinding of sensitive light caliper material, you can count on fine Wichita equipped machines such as this Dusenberry Unwind. If you have a particularly tough clutching or braking problem on any equipment, it will pay you to call a Wichita Engineer. Write for a copy of the colorful new Wichita Catalog.

*For any difficult clutching or braking problem...*

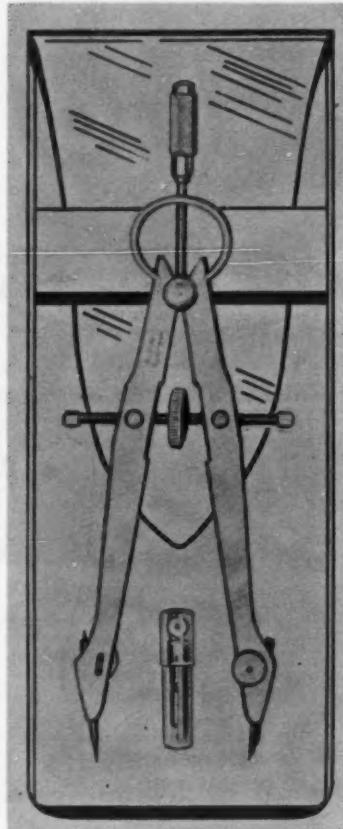
CONTACT YOUR NEAREST WICHITA ENGINEER

Clutch & Control Engineering Co., Livonia, Mich.  
Fremont & Lewis, Inc., Cincinnati, Ohio  
W. G. Kerr Company, Pittsburgh, Pa.  
Smith-Keser & Co., Avon, Conn.  
Philadelphia 44, Pa., and New York, N. Y.  
Frank W. Yarline Co., Chicago, Illinois  
Larry W. McDowell, Long Beach, California  
Andrew T. Label, Denver, Colorado  
Robert R. King Co., Cleveland, Ohio  
Norman Williams, Houston, Texas

Allied Transmission Equipment Co.,  
Kansas City 8, Missouri  
Donald E. Harman, Dallas, Texas  
C. Arthur Weaver, Richmond, Virginia  
Malcolm S. Cone, Memphis, Tennessee  
Dominion Power Press Equipment, Ltd.,  
Burlington, Ontario, Canada  
R. E. Kunz, Seattle 4, Wash.  
Norman Rupp Co., Portland 4, Ore.  
Bates Sales Co., St. Louis 1, Mo.



Students and professionals can have a 6-inch bow compass which incorporates features of expensive models. The instrument is designed of anodized aluminum for lighter weight and proper balance. Center assembly is of steel for durability with nickel spindle caps and supporting steel parts. Center wheel adjusts easily for circles



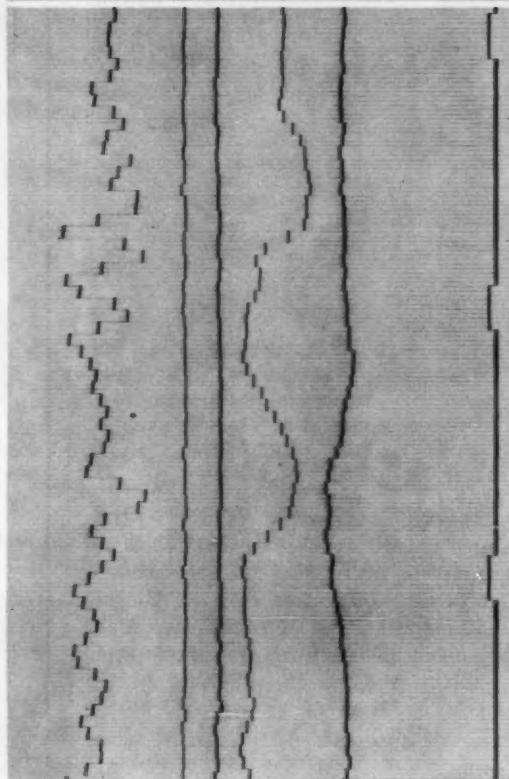
ranging from  $\frac{1}{8}$  to 9 inches in diameter. Divider needle and shoulder needle points are held by a plastic tube which also carries compass lead and spare parts. This low-priced drawing aid is enclosed in a protective vinyl case for easy handling.

Alvin & Co., Inc., 611 Palisade Ave., Windsor, Conn.

Circle 99 on Reader-Service Card

Circle 98 on Reader-Service Card

## Tracking a Surveillance Drone with the Visicorder



Record shown  $\frac{1}{4}$  actual size.

Drone surveillance and reconnaissance gives U.S. Army combat units a high-altitude vantage point with much broader horizons from which to view battlefield action and terrain.

If effective use of the data gathered by the drone—the “eye in the sky”—is to be made, accurate instruments have to be on hand to monitor the drone's position and movement, its operational behavior and its response to flight commands. Telemetry supplies the radio link which transmits all this behavior information to a thoroughly-instrumented mobile tactical command post developed by Tele-Dynamics Division of American Bosch Arma Corp.

The Honeywell Model 1012 Visicorder has been selected as the direct readout unit in the Tele-Dynamics Drone Surveillance Telemetry system. In use with its companion instrumentation, the 36-channel Visicorder simultaneously displays the 22 channels of information required to track a drone, plus the timing traces.

In the Tele-Dynamics van, which serves as a tactical command post, the Visicorder provides both an instant “quick look” and a permanent record of the drone's operational parameters.

Signals are transmitted over a single channel by time-multiplexing. Signal and battery strength, engine speed and temperature, pitch and roll commands, altitude, air-speed, attitude (pitch and roll), yaw, acceleration (horizontal and vertical), and angle of attack are recorded by the Visicorder, along with three separate records of vibration.

Like the other units of the Tele-Dynamics system, these Honeywell Visicorders are built for rugged service . . . to deliver the data . . . when the drone is up and the chips are down.

Call your nearest Minneapolis-Honeywell Industrial Sales Office for a demonstration of how a Visicorder Oscillograph will save you time and money in data acquisition. OEM inquiries invited.

Reference Data: write for bulletins 906, 1012, 1108 and 1406.

**Minneapolis-Honeywell Regulator Co.**  
**Industrial Products Group, Heiland Division**  
**5200 E. Evans Avenue, Denver 22, Colorado**

### Honeywell



*Industrial Products Group*

HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world.

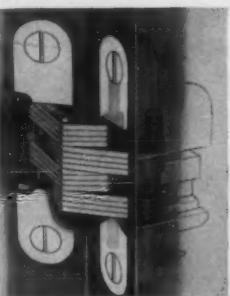
## NEW INVISIBLE HINGES

### General Purpose Hinge Creates Flush Surfaces

These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.

SOSS MANUFACTURING COMPANY, Dept. DN-25, P. O. Box 38, Harper Station, Detroit 13, Michigan.

Circle 100 on Reader-Service Card for more information



## EQUIPMENT

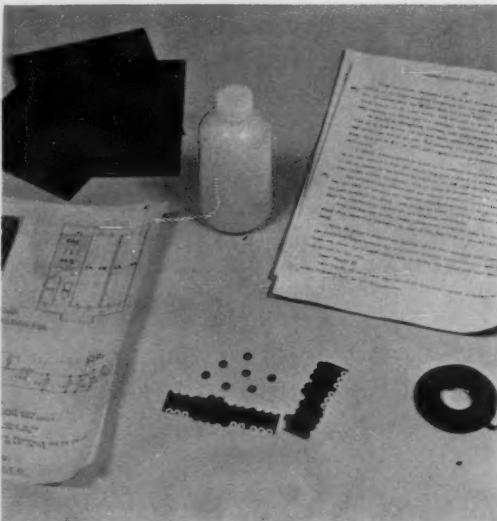
### 24-Inch Centering Rule 353

**Automatically Divides, Proportions, Scales and Centers**

Length	Gage	Width
6 inches	.040	7/8 inch
12 inches	.040	7/8 inch
15 inches	.040	1-1/16 inches
18 inches	.040	1-1/8 inches
24 inches	.064	1-1/4 inches
30 inches	.064	1-1/2 inches
36 inches	.081	1-3/4 inches
48 inches	.081	2 inches
60 inches	.102	2 inches
72 inches	.102	2 inches
84 inches	.102	2 inches
96 inches	.102	2 inches
144 inches		

Fairgate Rule Co., Inc., Cold Spring, N. Y.

### Printed-Circuit Kit 354



The "Quik-Cirkit" enables the engineer to construct printed circuits at his own desk. Each kit contains complete instructions and materials—copper-clad board, liquid chemical etch, etch-resistant terminal pads and etch-resistant tape. There are enough materials to make three printed wiring boards. Plastic etchant tray is also included.

Advanced Designs Inc., 914 Lullaby Lane, South Vienna, Va.

**SOLENOID VALVES**  
can you afford the  
**HIGH COST** of Low Price  
Tags?

Entire production systems depend on the successful operation of control instruments like solenoid valves. Malfunction or failure of a solenoid valve causes downtime and loss of production monstrously out of proportion to the cost of the valve itself. When you're tempted by an alluring low price tag on a solenoid valve, think ahead. Will the few dollars you save pay for the downtime and the service and replacement costs?

Atkomatic solenoid valves are a far-sighted investment in system-wide efficiency. Atkomatic manufactures a full line of bronze and stainless steel valves for all media in pressure groups ranging from zero to 10,000 psi.

Write today for Catalog No. 444.

**Atkomatic** VALVE CO., INC.  
545 W. ABBOTT STREET • INDIANAPOLIS, INDIANA  
ENGINEERING 20 years KNOW HOW

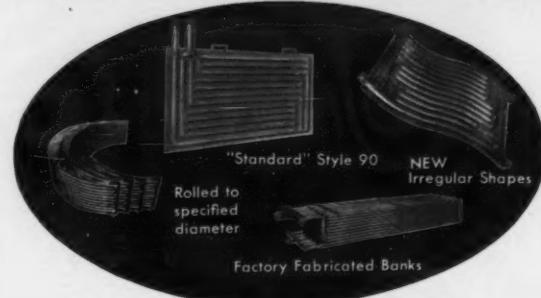
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84

## PLATECOIL®

FOR ALL KINDS OF TANK AND PROCESS HEATING AND COOLING

- Built to fit application requirements
- High heat transfer capacity
- Compact units save space
- Easy to install
- Easy to remove for cleaning
- Available in variety of weldable metals
- Operating Pressures up to 250 psig.



Send for  
Bulletin P51

## PLATECOIL® DIVISION

TRANTER MANUFACTURING, INC., LANSING 9, MICHIGAN

Circle 102 on Reader-Service Card for more information

## New...from MARSH!

**Small solenoid valves that fill a BIG order**

### MARSH Master-mite SOLENOID VALVES



Conduit-type Master-mite. Grommet-type also available.

Write for  
new bulletin

**MARSH INSTRUMENT COMPANY**  
Dept. 38, Skokie, Illinois

Division of Colorado Oil and Gas Corporation  
Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada, Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.

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DESIGN NEWS—JANUARY 16, 1961

**WIDE ANGLE**      **93° to 115°**

**SQUARE SPRAY**

**A NEW DESIGN IN**

**FullJet SPRAY NOZZLES**

For numerous multiple-nozzle applications, because the square spray patterns "fit together", here are nozzles that make possible uniform, complete coverage with fewer nozzles per manifold. This is the latest design in Spraying Systems' very complete line of FullJet nozzles in square and standard-circular spray patterns. For complete information write for Bulletin 105 and Catalog 24.

**SPRAYING SYSTEMS CO.**  
3241 Randolph Street • Bellwood, Illinois

AMERICA'S MOST COMPLETE LINE OF SPRAY NOZZLES  
Circle 104 on Reader-Service Card for more information



### engineered to meet your needs

Careful analysis and testing of your product together with experienced RAE Engineers is your assurance of the best motor for the job. RAE offers outstanding service and quality in a large variety of motors in voltages up to 250, and up to 1/8 H.P. (higher for intermittent duty) with many gear head motor combinations. Let us put our years of motor building experience to work for you.

Send for the "RAE" service sheet.  
It will help you supply the data necessary for recommendations and prices.

**Rae** MOTOR CORP.  
2009 Keweenaw St. • Racine, Wis.

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DESIGN NEWS—JANUARY 16, 1961

### Aluminum Rule 355

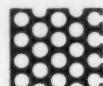


A hard, anodized aluminum rule is useful in such applications as machinery where an impressed rule is required for heavy usage. Lightweight and durable for easy handling, the rule is available in 1-inch width, 1/10-inch thick, in all lengths. Numbers are from left to right or right to left. Numbers and calibrations are stamped deep for permanence.

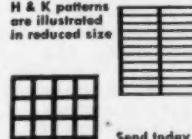
Fairgate Rule Co., Inc.,  
Cold Spring, N. Y.

*Idea!*

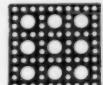
**mock-up  
projects  
design**



A few of the thousands of H & K patterns are illustrated in reduced size



Send today to nearest H & K office for General Catalog



### with H & K perforated metals

Here is an H & K perforated metal grille utilized in a mock-up of a record player. This greatly helps the Industrial Designer project his concepts as H & K perforated metal is now in its proper element for consideration of use and selection of pattern.

By referring to the H & K General Catalog, the designer can select one or more patterns for his project.

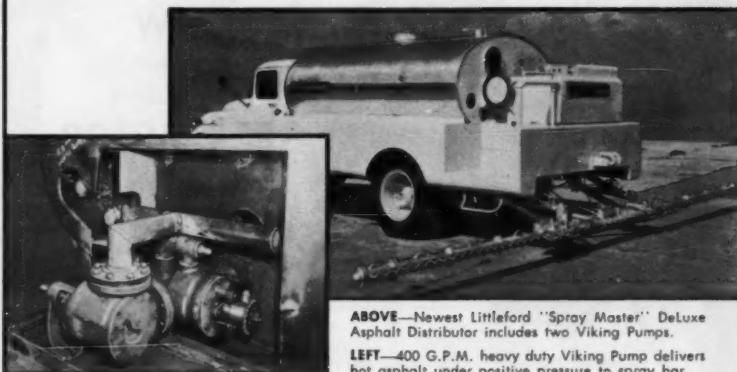
H & K perforated metals provide the Industrial Designer, and other men of ideas, a medium of unlimited opportunities for designing better and more attractive products.

**THE Harrington & King PERFORATING CO. INC.**

Chicago Office and Warehouse • New York Office and Warehouse  
5631 Fillmore Street • 114 Liberty Street, Dept. DN  
Chicago 44, Illinois • New York, New York

Circle 106 on Reader-Service Card for more information

### IT TAKES RUGGED PUMPS TO SPRAY HOT ASPHALT



### Drawing Aids 356

A 13-piece drawing instrument set, designed for the professional and economically priced, consists of nickel-silver instruments and is packaged in a velvet-lined green leatherette case. Instruments in the set include a 6½-inch central thumbscrew bow compass with double-fast opening and closing action; 5¾-inch extension bar; 4½-inch bow compass; 6-inch dividers; 5½-inch ruling pen with stainless-steel blades of cross-hinge type for easier cleaning; pen handle; leads, spare parts and needle points; center pin; and a screwdriver.

Keuffel & Esser Co., Third & Adams Sts., Hoboken, N. J.

ABOVE—Newest Littleford "Spray Master" Deluxe Asphalt Distributor includes two Viking Pumps.

LEFT—400 G.P.M. heavy duty Viking Pump delivers hot asphalt under positive pressure to spray bar.

Yes, rugged equipment is required for the tough job of laying hot asphalt on roads. That's why Littleford Brothers, Cincinnati, Ohio, selected VIKING PUMPS as standard equipment on their most modern "Spray Master" distributors. And VIKINGS do more than give rugged service—they solve the problem of big capacity and small space, yet operate at high temperatures.

Pumping asphalt is just one of many tough jobs performed by VIKING PUMPS. From little one-half gallon per minute pumps to 1050 G.P.M. giants, VIKING PUMPS are faithfully delivering a smooth, even flow of liquids—hot, temperate or cold—thick, medium or thin. If you have a problem in moving semi-solids or liquids, VIKING PUMPS may be the answer for you, as they were for Littleford Brothers. Tell us your problem and ask for bulletin GJ. . . . VIKING PUMP COMPANY, Cedar Falls, Iowa, U.S.A. In Canada, it's ROTO-KING Pumps. See Our Catalog in Sweet's Product Design File.

Circle 107 on Reader-Service Card for more information

# NEW! 3 INCHES OF LOW COST POWER: HOWARD

FRACTIONAL  
H.P. INDUCTION  
MOTOR



for Typewriters—Business Machines—  
Computers—Recorders—Appliances—  
MORE POWER, SMALLER SIZE, LONGER  
LIFE, TOUGHER CONSTRUCTION...ALL  
AT LOWER COST!  
• 3" diameter—26 frame size • 2 pole ratings  
from 15 milli-h.p. to 1/10 h.p. • 4 pole ratings  
from 15 milli-h.p. to 1/20 h.p. • Available in  
hysteresis synchronous, permanent split  
capacitor, split phase and capacitor start  
models • Single or double shaft • Resilient  
mount, foot mount or face mount  
Write today for samples and prices!

Divisions: Electric Motor Corp. Cyclohm Motor Corp. Loyd Scruggs Co.

**HOWARD INDUSTRIES, INC.** • 1705 State Street • Racine, Wisconsin  
Circle 108 on Reader-Service Card for more information



A two-pole, shaded pole AC induction motor with totally enclosed die cast gear-reducer. Available for 6 to 220 volts, 50 or 60 cycle AC. Gear-reducer speeds,  $\frac{1}{2}$  to 300 rpm. Output torque up to 50 inch lbs. at  $\frac{1}{2}$  rpm. Precision worm drive. Output shafts,  $\frac{3}{16}$ ",  $\frac{1}{4}$ ",  $\frac{5}{16}$ ",  $\frac{3}{8}$ ". Mounts in any position. Ideal for motorized office equipment, revolving displays, vending machines, remote TV tuning, etc. Optional: solenoid brake for fast stopping; overload thermal protection; varnish impregnated stator; stainless steel or plated shafts.

We custom-design motors up to 1/40 h.p.; 6 to 220 v., 50 or 60 cycle;  $\frac{1}{2}$  to 800 rpm.; torque up to 200 inch lbs. Special gear-reducers designed to your requirements at low cost. Send for details.



**Molon Motor & Coil Corp.**

3737 Industrial Avenue • Rolling Meadows, Illinois  
Custom Designers and Manufacturers of Sub-Fractional Horsepower Motors and Gear-Reducers

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## EQUIPMENT

### Automatic Hand Tacker 357

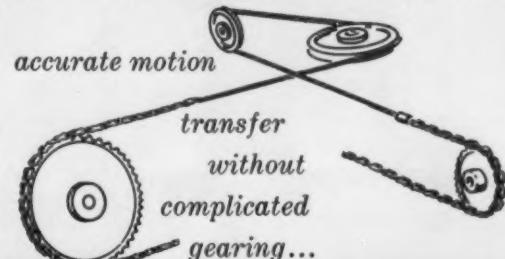
This device eliminates the need to buy thumbtacks and other tacking devices, and dispenses a 3-prong circular steel pin with a minimum of pressure. It then retracts pin with equal ease and can be used again. "Color-Fix" is useful for mechanical engineers, draftsmen and artists as a dispenser and retractor of drawing pins. It is also suited for anyone doing dis-



play work. The compact plastic and steel unit has good spring action and enables user to place pins in hard as well as soft materials. Each tacking gun is filled with 15 tacks and refills are available. Full capacity of the unit is approximately 50 to 60 tacks.

Reliance Pen & Pencil Corp., Mt. Vernon, N. Y.

## MORE DESIGN FREEDOM



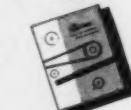
### SIERRA MINIATURE MECHANICAL CHAIN AND SPROCKETS...

Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance —wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per linear ft. Material: stainless steel, or other materials.

**Sierra** ENGINEERING COMPANY

123 East Montecito • Sierra Madre, California

### NEW CATALOG



Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. Write for yours today.

T. M. REG.

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ENGINEERS!  
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7. Fast delivery (prototypes in 4 weeks).
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**TA Mfg. Corp.** 4607 Alger Street • Los Angeles 39, Calif.  
(or call CH 5-3748)

TWX 9063 Glendale, Calif. • WUX CAT Los Angeles, Calif.

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Brochure No. 660,  
a bulletin of facilities  
and abilities. It explains how we can help you on  
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McGILL MFG. CO., Bearing Div., 203 N. LAFAYETTE ST., VALPARAISO, IND.  
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Clum Key Switches are precision-engineered for continuous dependability in starting and stopping of engines in your high quality products — automotive, tractor, and marine. Available with silver contacts for high current usage.

Available as "Standards" or built to your specifications.

WRITE TODAY . . . for complete engineering data  
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Type "A" — "Off-run-start."  
Aluminum die cast case.  
Iridited,  $\frac{3}{8}$ " — 20 thread.  
Start position lock plug  
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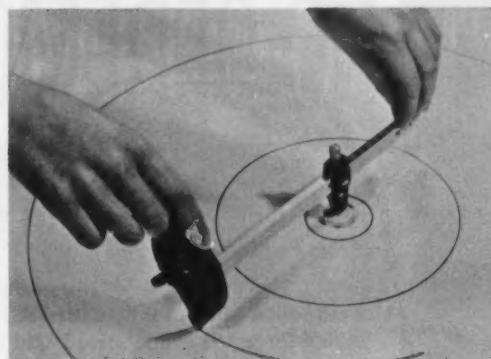
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CLUM MANUFACTURING COMPANY  
611 West National Avenue • Milwaukee 4, Wisconsin

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DESIGN NEWS—JANUARY 16, 1961

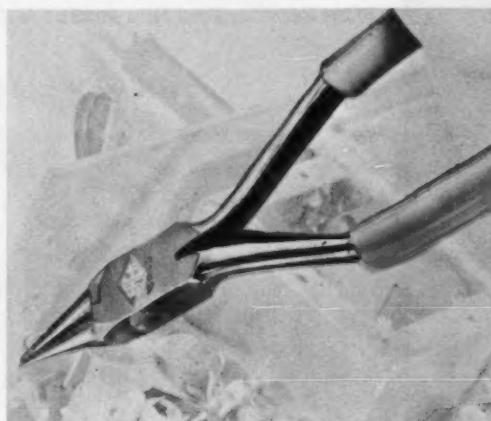
## 'Tape-Pen' Beam Compass 358



As an aid to draftsmen, this device reduces tedious work with pen and pencil by drawing precise circles and arcs with all narrow-width "Curve-Line" tapes. Adjustable for making circles of various sizes, it has radii of 1 to 9 inches. If longer radii are desired, additional standard-length beam sections may be coupled to basic beam. Basic dispensing instrument allows tape to be "rolled on" easily in a line either freehand or following a guide.

Chart-Pak, Inc., One River Rd., Leeds, Mass.

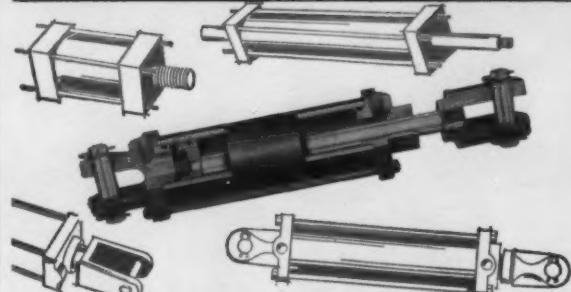
## Miniaturization Pliers 359



The trend to miniaturize components and demand for hand tools designed for working in deep, confined areas has prompted the design of these precision hand tools. The midget diagonal cutter, long, narrow chain-nose plier, the extra-fine and cutting nipper and long, round-nose plier feature handles lengthened to 6 inches. Tools also now have cushion grips and leaf springs for easier manipulation.

R. N. Hunter Sales Co., Inc., 9851 Alburstis Ave., Santa Fe Springs, Calif.

there's a **CROSS** air or hydraulic cylinder that will work for you\*



\*Cross Air or Hydraulic Cylinders save money, do the job better! To be sure it's the best cylinder designed for your job — select Cross. Cross cylinders are designed around component parts, easily modified to fit your specific production applications. Cross cylinders are heavy-duty, rugged cylinders for OEM.

## CROSS MANUFACTURING CO. LEWIS, KANSAS

<b>Cross</b>	For more complete data on sizes carried in factory stocks — write today — Engineering Catalog on Cross Air and Hydraulic Cylinders available on request.
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<b>CONDUIT LOCKNUTS</b> —Up to 6"	<b>WELD NUTS</b> Square & Hexagon	<b>MACHINE SCREW &amp; FINISHED NUTS</b>
<b>STOP-NUTS</b>	<b>WING NUTS</b>	<b>SPRING-NUTS</b>
<b>WAFFLE FACE LOCKNUTS</b>	<b>LOCKNUTS</b> Reversible — One Piece	<b>SWITCH MOUNTING NUTS</b>
<b>COLD HEADED PLUGS &amp; BUSHINGS</b>	<b>LOCKNUTS</b> Deflected Top	<b>IMPACT EXTRUSIONS</b>

Available in Stainless Steel, Brass, Aluminum and Steel  
**JACOBSON NUT MFG. CORP.** Kenilworth,  
New Jersey

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**OHIO** WELDED TUBING

## CORNERSTONE-LAYING WITH

# NO CEREMONY

In today's hustling, bustling construction business there's no time to stand on ceremony . . . no point in risking costly equipment failure.

To short-circuit mechanical downtime, leading construction equipment producers specify Ohio Tubing for power cylinders and fluid lines, mechanical and structural members. This gives equipment the heft and brawn to shrug off brutal, grinding punishment . . . gives equipment users a high degree of protection against disastrous delays.

You can strengthen your product — and its mechanical reputation — by specifying Ohio *Custom Made* Tubing. The name Ohio is the hallmark of the highest quality in tubing, both seamless and welded. And we're now able to deliver a broader range of welded tubing sizes, wall thicknesses and grades than ever before.

Let's not stand on ceremony. We want your tubing business — seamless to 7" OD, *welded up to 7½" OD*. For a fast start, contact your nearest Ohio representative, or send part drawings to the plant at *Shelby, Ohio—Birthplace of the Seamless Steel Tube Industry In America*.



Ohio Seamless offers the broadest parallel range of both welded and seamless quality steel tubing in the industry.

**OHIO OHIO SEAMLESS TUBE**  
Division of Copperweld Steel Company • SHELBY, OHIO  
Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

Representatives in principal cities. Check leading directories: THOMAS', MacRAE'S, CONOVER-MAST, SWEET'S, FRASER'S.

A-2000A

## EQUIPMENT

### Pocket Transmitter

361

Eleven transistors in the various stages of this unit provide high reliability, low power consumption characteristics and compactness. "Handie-Talkie" operates on frequencies between 25-54 mc and 132-174 mc. It provides 500 milliwatts RF power output. Weighing only 14½ oz and measuring 5½ by 2½ by 1⅛ inches, the unit is



completely self-contained including microphone, antenna and batteries. Two antennas are available — a solid steel whip and a collapsible whip antenna. The unit can be operated interchangeably from either nickel-cadmium batteries or mercury cells. With a 10-percent transmit duty cycle, the rechargeable supply provides up to 9 hrs operation per charge, while replaceable mercury cells last up to 80 working hrs.

Motorola, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill.



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**Specify BETTER FLATNESS and FINISH ...**

**NEW CATALOG TELLS HOW**

## **PRODUCTION LAPPING**

### **CAN IMPROVE YOUR PRODUCT**

Get the answers to any questions you may have about product improvement through machine lapping. You'll see why you can specify a flatness of .0000116" and a finish of 2 to 3 AA and be sure that you'll be able to produce it on a production basis with the Lapmaster. Send for your copy of the new Lapmaster catalog.



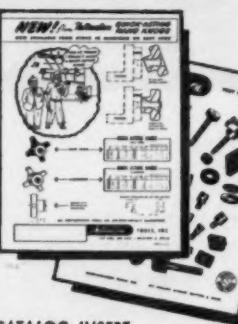
**CRANE PACKING COMPANY**  
6423 OAKTON STREET  
MORTON GROVE, ILL. (Chicago Suburb)

In Canada:  
Crane Packing Co., Ltd., Hamilton, Ont.

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LATCH BOLTS  
CAST IRON HAND KNOBS  
ALUMINUM HAND KNOBS  
QUARTER TURN SCREWS  
SHOULDER SCREWS  
JIG FEET (3 TYPES)  
SPHERICAL WASHERS  
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KNULED HEAD SCREWS  
TOGGLE SHOE CLAMPS & V-PADS

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T-NUT & STUD SETS  
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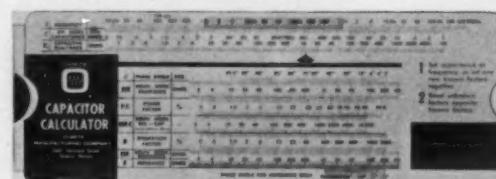
115 HOLLIER AVE., DAYTON 3, OHIO



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DESIGN NEWS—JANUARY 16, 1961

## **Capacitor Calculator**



With one setting of the slide rule, this calculator gives the solution to problems involving frequency, reactance, power factor, dissipation factor, equivalent series resistance, impedance and phase angle. A convenient pocket size (7 by 2 1/8 inches), slide-rule type calculator is constructed of heavy varnished cardboard. It is not necessary to set slide to effect conversions between power factor, equivalent series resistance and dissipation factor. Calculator also lists important capacitance formulae and has a comparison chart of different types of capacitors. This designers' aid is available at a net price of \$0.25. Send requests with coin to manufacturer, mentioning DESIGN NEWS.

Ohmite Mfg. Co., 3629 Howard St., Skokie, Ill.

## **Hex Key Kits**

**360**



Handy kits of Allen hex keys include 7/64 and 9/64-inch sizes for No. 6 and No. 8 '60 series cap screws. No. 664 "Junior" key kit has 9 plated hex keys from 5/64 through 1/4 inch that fit set screws from No. 8 through 1/2 inch and '60 series cap screws from No. 2 through 5/16 inch. No. 666, the "Handy-Pac", has 15 plated hex keys from 0.028 through 3/8 inch that fit set screws from No. 0 through 3/4 inch and '60 series cap screws from No. 0 through 1/2 inch. Assortments are packed in plastic snap-button envelopes.

Allen Mfg. Co., Hartford, Conn.

## **AUTO-POENT®**

### **HYDRAULIC FULL FLOW VALVES**

Flow Control, Needle, Check,  
for HYDRAULIC Power  
Model KF Flow Control Valve with Dial  
and Knob adjustment for direct reading  
and duplicating reference. Now  
available in Aluminum for 3000 psi.  
Part. #2,841, 174

A complete line: 1/8", 1/4", 3/8", 1/2", and 3/4" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical  
Tube Sizes on special order.

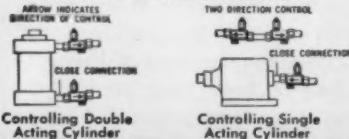
MINIMUM PRESSURE DROP AND POWER LOSS . . . Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.

EASY FLOW ADJUSTMENTS under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.

SENSITIVE, CHATTERLESS BALL CHECK . . . Patented design insures rapid ball movement to open or close at low differentials.

FORGED BODIES permit higher pressures with wide safety margins. Aluminum—3000 psi; Steel and Stainless Steel—5,000 psi. Pressure ratings based on better than 5 to 1 safety factor. All internal parts are Stainless. Write for illustrated catalog.

#### **TYPICAL APPLICATIONS**



**AUTO-POENT INC. © 2921 GRANT STREET  
COMPONENTS BELLWOOD (Chicago Suburb) ILLINOIS**

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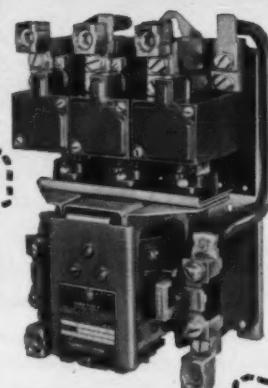
**New SIZE 4 STARTER  
is 33% smaller!**

• Greatly reduced size  
with no sacrifice in me-  
chanical or electrical life

• Easy maintenance—  
full accessibility—  
quick contact change

• Room for up to 4  
double-circuit interlocks

• Simplified 3-hole  
mounting



Write for details. Square D Company, 4041 North Richards Street,  
Milwaukee 12, Wisconsin



**SQUARE D COMPANY**

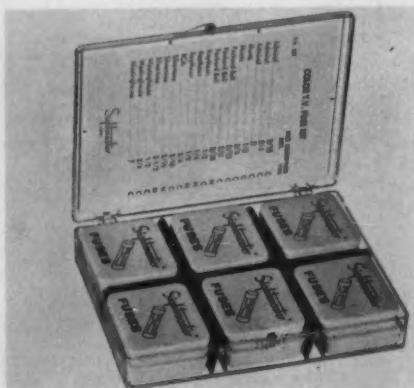
wherever electricity is distributed and controlled

Circle 119 on Reader-Service Card for more information

## EQUIPMENT

### Color TV Fuse Kit

362



Nine fuse types used exclusively in all color TV sets are now available in a low-cost kit. To solve the serviceman's problem of having these special fuses on hand when needed, a 60-fuse assortment has been prepared. Fuses are packaged in a re-usable plastic box designed with six compartments. It also contains a table telling which fuses are required for each make of color TV set.

Sightmaster Corp., 50 Aleppo St., Providence, R. I.

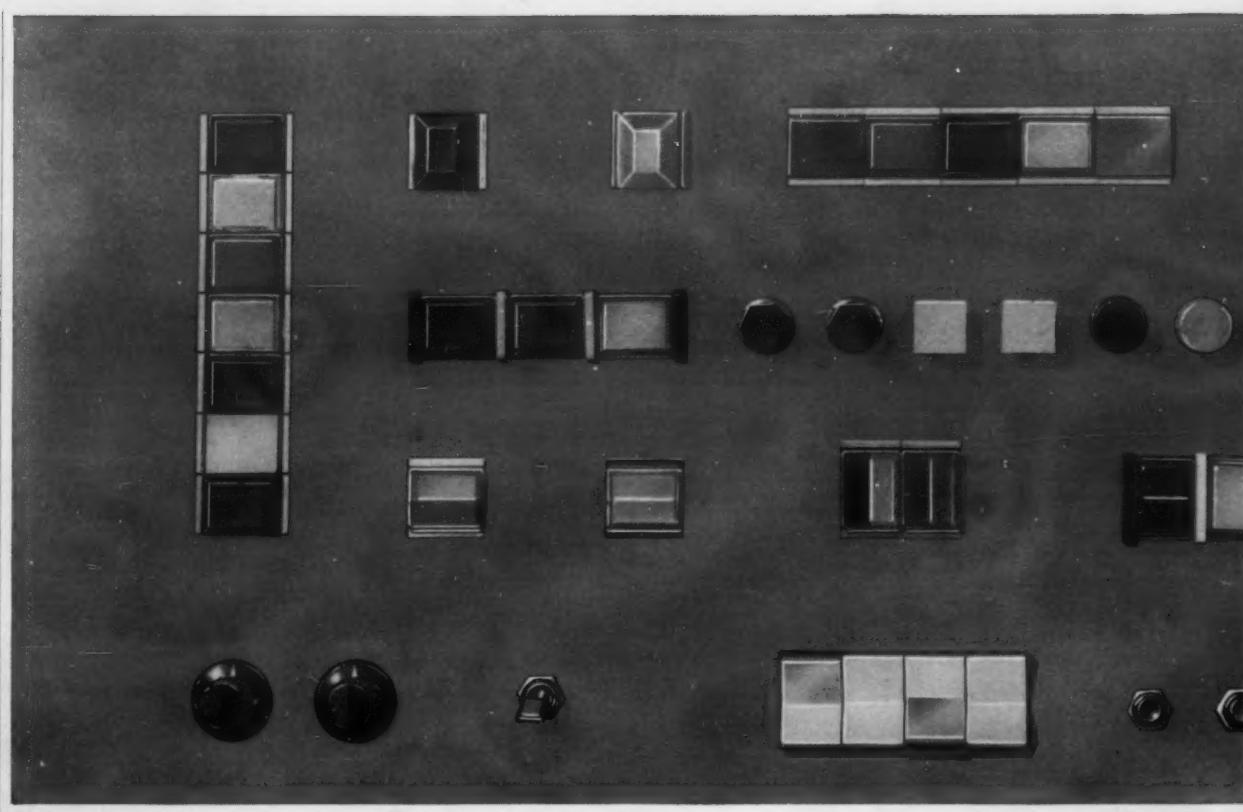
### R and D Terminal Kit

363



Research, development and engineering personnel can continue experimental work without interruption by selecting the right lug, clip or terminal to meet their needs from this complete assortment of over 500 stampings. Lugs and terminals are hot tinned for easy soldering. Kit is packaged in a plastic box with see-through lid.

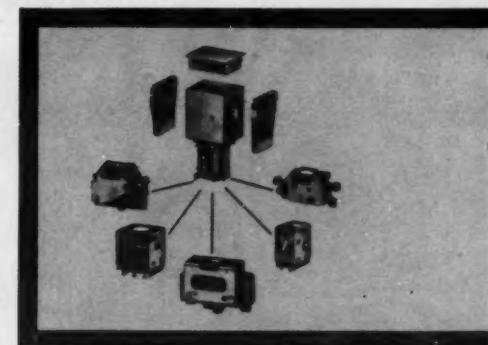
Zierick Mfg. Corp., 110 Beechwood Ave., New Rochelle, N. Y.



**NEW**  
(Actual Size)

**"302 PB" Miniaturized Lighted Push-Button Switch**

Indicator and switch unit with momentary action—actuated only while the button is depressed—both combined in less than one cubic inch. The "302 PB" Series conforms to the requirements of MIL-S-6743, MIL-S-6744 and MIL-E-5272A. Write for Data Sheet 182.



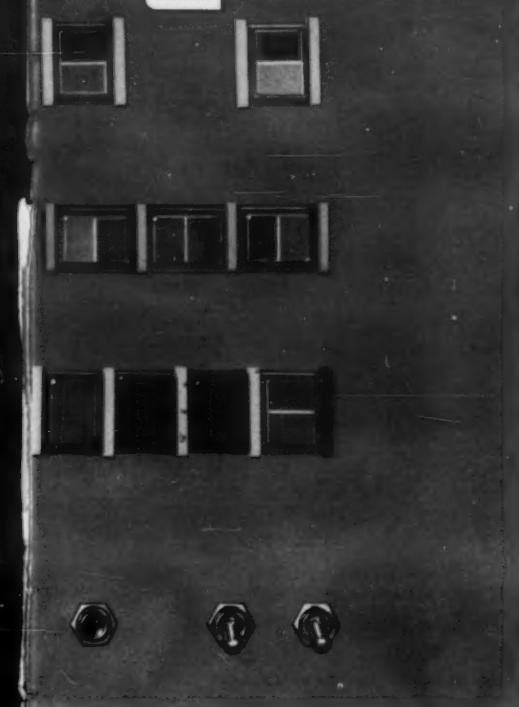
**MICRO SWITCH . . . FREEPORT, ILLINOIS**  
A division of Honeywell  
*In Canada: Honeywell Controls, Limited, Toronto 17, Ontario*



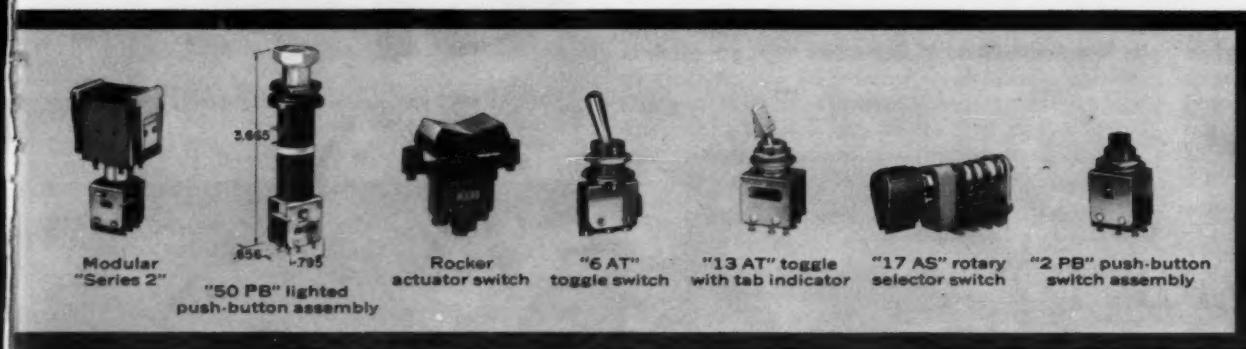
**Honeywell**  
MICRO SWITCH Precision Switches



## MICRO SWITCH Precision Switches



### MICRO SWITCH HAS MORE ANSWERS FOR CUSTOMIZING YOUR CONTROL PANELS!



#### MORE SWITCH DESIGNS, MORE FLEXIBILITY IN THE MICRO SWITCH PUSH-BUTTON LINES

When you want a control panel precisely tailored to your equipment and absolutely reliable, start with MICRO SWITCH. You'll find the wider selection fits your ideas, rather than your ideas having to fit the selection.

New "302 PB" Miniaturized Lighted Push-Button Switches provide infinite lamp life, double-pole double-throw switching and 2-color indication in a unit requiring only one cubic inch of panel space.

Modular "Series 2" Lighted Push-Button Switches offer customized combinations of eight

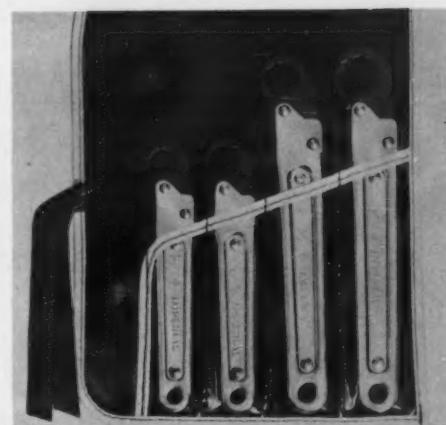
different basic switches and dozens of colored indicators—and they snap together without tools. New truncated display screens add dimensional visibility.

MICRO SWITCH also makes the "Series 50 PB" lighted push-button switches as well as hundreds of different toggle switches and assemblies. Everything you need for customizing control panels. See the Yellow Pages for the nearby MICRO SWITCH Branch Office. Write for illustrated catalogs on push-button and toggle switches for control panels and machine control stations.

Circle 121 on Reader-Service Card for more information

## Ratchet Wrench Kit

364

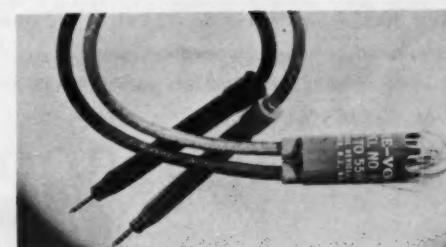


The popular sizes of four ratchet wrenches are now offered in a roll-up vinyl kit. The set, designated catalog No. 399-F, contains  $\frac{1}{2}$ ,  $\frac{9}{16}$ ,  $\frac{5}{8}$  and  $\frac{3}{4}$ -inch ratchets. Lightweight wrenches speed fitting assembly and are useful tools for close-quarter work. They may be used for installing tube, high-pressure hose, hydraulic hose and pipe fittings, as well as other applications.

Imperial-Eastman Corp., 6300 W. Howard St., Chicago 48, Ill.

## A-C/D-C Test Light

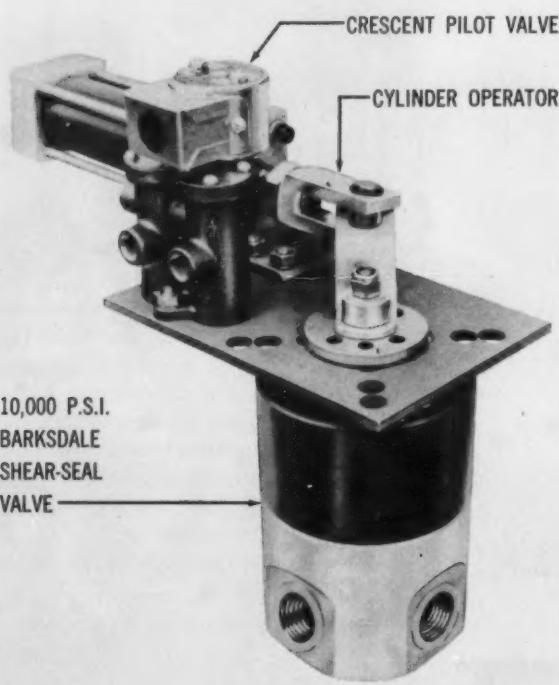
365



A multi-application test light, the "line-volt", will indicate presence of power; check fuses; identify a-c or d-c lines, grounded components, continuity of line circuits; and satisfy other testing needs in the 55 to 500v a-c or 90 to 600v d-c range. Features of device are: rugged construction for tool-box totting; 12-inch heavy-duty flexible leads with sharp test prods for piercing insulation, oxide coatings, paint and other materials; a bright glow, burn-out and vibration-proof neon.

Industrial Devices, Inc., 982 River Rd., Edgewater, N. J.

# CYLINDER OPERATED "SHEAR-SEAL" VALVES



Remote control operators for 10000 P.S.I., 6000 P.S.I. and 3000 P.S.I. "Shear-Seal" Valves are available with cushioned or non-cushioned cylinders. 4-Way, 3-Way and Shut-off valves range in pipe sizes from  $\frac{1}{4}$ " to  $1\frac{1}{2}$ " N.P.T.

For complete data request catalog COV-60-61.



CONTROL VALVE DIVISION

**Barksdale valves**  
5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

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DESIGN IDEAS  
NEWS

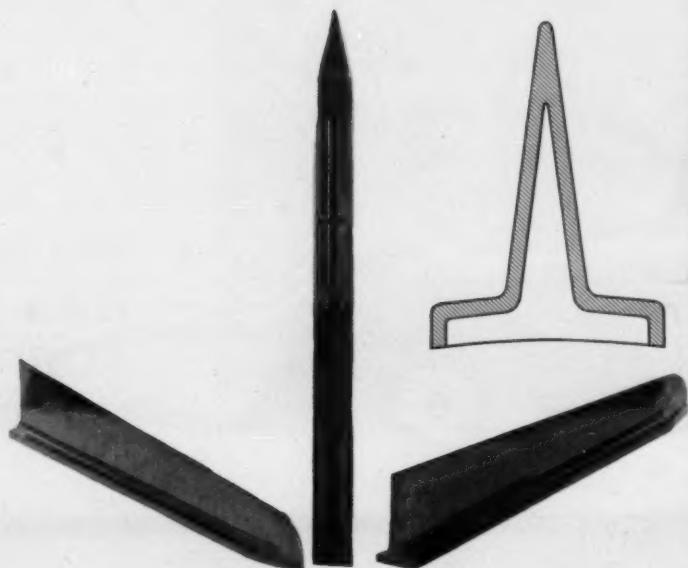
MATERIALS APPLICATIONS

## Reinforced Phenolic Replaces Metals

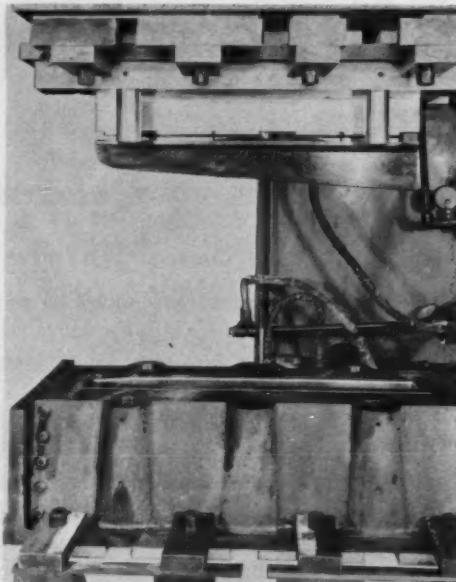
Edward W. Schrader, Western Editor



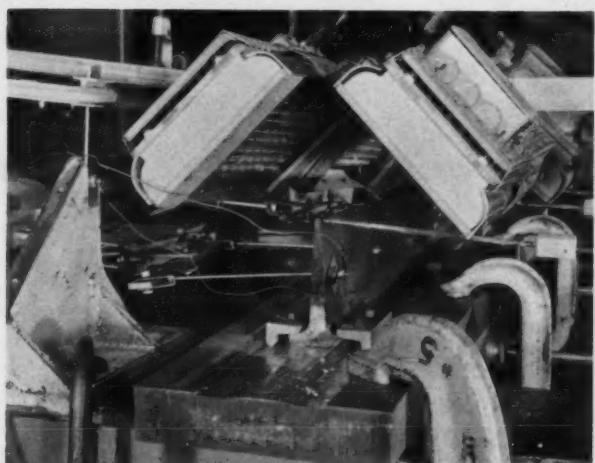
MISSILE FUSELAGE TEST SECTION is 14 inches in dia by 36 inches long.



WING SECTION produced by high-pressure molding for tests at above 1000F temperatures.



CLOSED STEEL DIE produces high-pressure molded missile wings.



INFRARED HEAT simulates atmospheric heating on wing section. Test load may be applied at any desired time during temperature cycle.

For Free Reprints of the Above Article, Circle 528 on Reader-Service Card

## For Molded Missile Fin

MATERIAL CHARACTERISTICS FOR MOLDED PLASTIC WING		
MECHANICAL PROPERTIES	ROOM TEMP	1000 F *
Ultimate tensile strength, psi	$3 \times 10^3$	$1.2 \times 10^3$
Ultimate compressive strength, psi	$14 \times 10^3$	$2.5 \times 10^3$
Ultimate flexural strength, psi	$16 \times 10^3$	$4.6 \times 10^3$
Ultimate dynamic modulus, psi	$2.5 \times 10^6$	$1.5 \times 10^6$ (500 F)

THERMAL PROPERTIES		
Thermal conductivity	0.16 Btu/hr/sq ft/deg F	
Specific heat	0.26 Btu/lb/deg F	
Coefficient of thermal expansion	$9 \times 10^{-6}$ inches/inch/deg F	

SPECIFIC GRAVITY	1.86
------------------	------

\* Surface temperature raised to 1000 F in 10 sec and then maintained at this temperature for 40 sec prior to application of test load.

A glass-fiber-reinforced phenolic wing section has been developed as a potential replacement for a cast magnesium part or a stainless-steel honeycomb fabricated part. The aerodynamic performance of the phenolic fin is the same as that of parts made with other materials. The plastic is molded accurately in a steel die. This technique makes reproducible parts from commercially available material at lower cost than the metal wings.

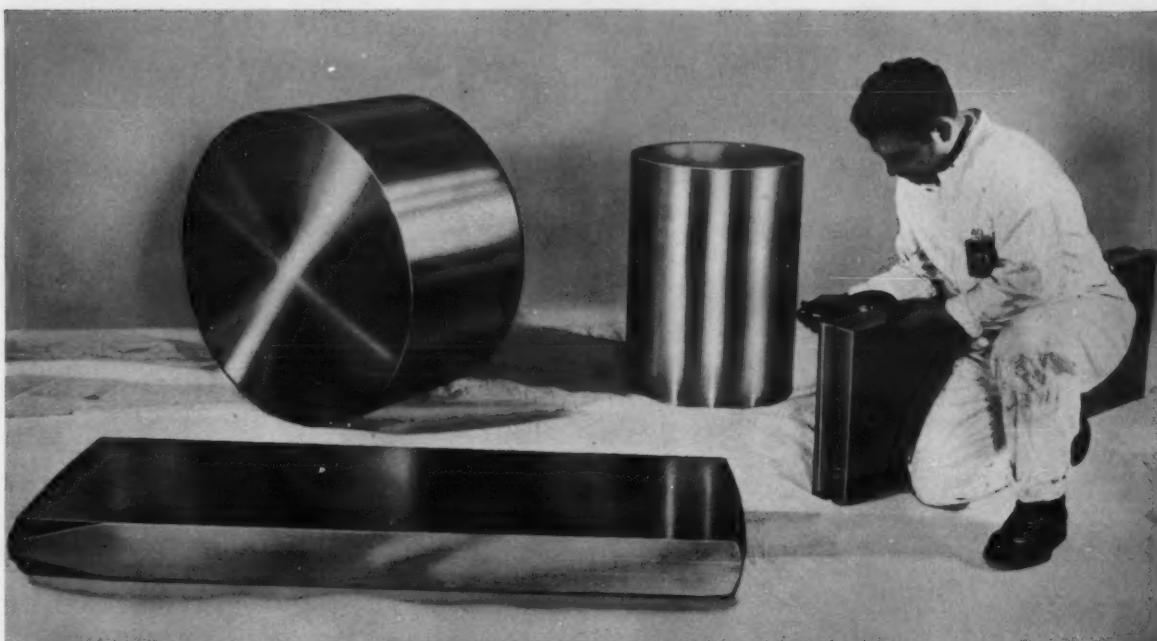
The randomly oriented glass fibers give high-temperature mechanical properties to the phenolic approaching those of the metal parts. The strength-to-weight ratio approaches that of the stainless-steel honeycomb structure and exceeds that of magnesium under flight conditions.

Environmental and structural tests show the material to be suitable for high-temperature, short-duration use. The phenolic fin, in tests, has withstood 1100F temperatures for a few minutes. The exterior of the thermosetting plastic exhibited some charring, but this was observed to be non-detrimental to the aerodynamic qualities of the fin. The material is also suitable for lower-temperature, long-duration use.

The use of randomly oriented fibers eliminates hand preforming of the material. The latter operation is required for oriented fibers, and of course adds to the fabrication cost, when that technique is used. The tapered cavity in the phenolic fin is larger than in a cast magnesium fin; thus, it uses less material and achieves a weight reduction in the part.

The molded plastic wing is a design development of The Hughes Aircraft Co., Culver City, Calif.

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Large beryllium pressings for nuclear and missile applications produced for General Electric Company.

## BERYLCO-Setting the Pace in Beryllium by Putting Proven Research Principles into Production

BERYLCO's consistent research leadership is simplifying the transition from laboratory to production line for aircraft and missile makers using beryllium. Chemical and spectrographic analysis, physical and mechanical property research, and pilot plant studies help produce rigid quality control procedures as well as a constant source of new testing data. BERYLCO can also

supply an experienced staff of field and plant technicians to assist you in your own product development, or product re-design, with beryllium. Call them in when you first start thinking about the advantages beryllium can add to your product's performance. Their ideas may help you eliminate some of those time-consuming steps between testing and production.

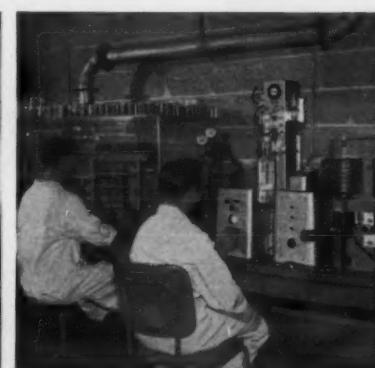


### THE BERYLLIUM CORPORATION

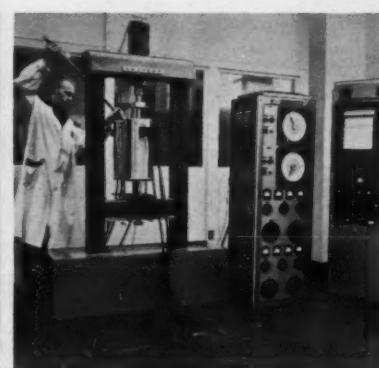
Reading, Pennsylvania



Spectrographic analysis of BERYLCO beryllium is important in controlling quality and assuring proper composition.



Conductometric carbon determination equipment is used to assure that both BERYLCO's and government specifications are met.

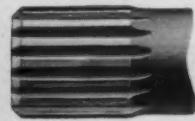


High temperature beryllium research is another segment of BERYLCO service that can speed your product development.

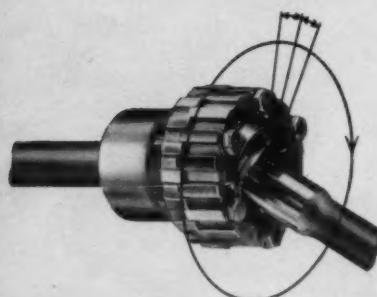
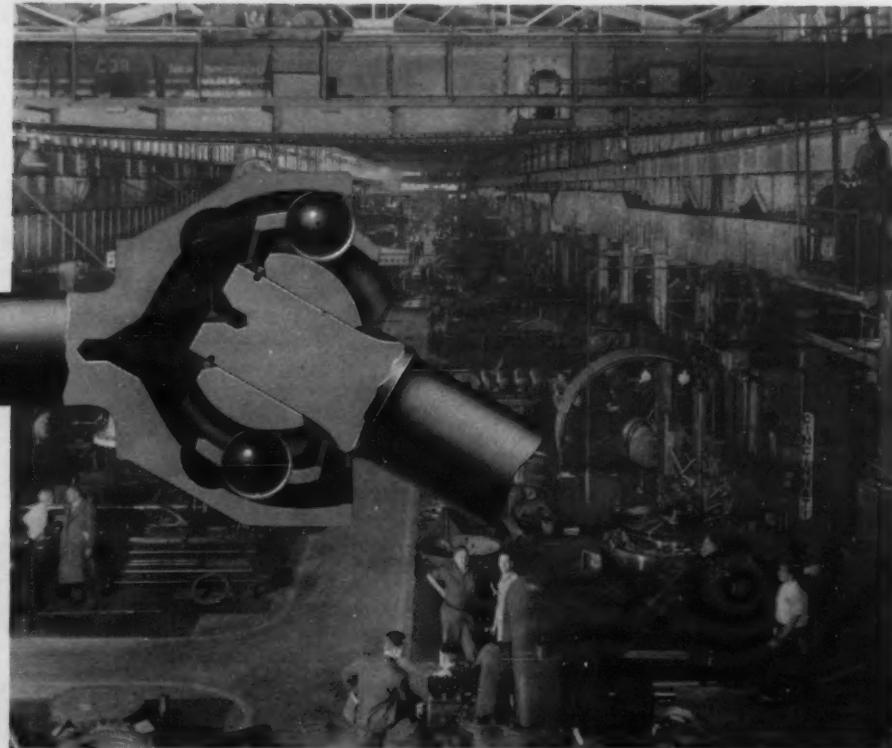
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# CON-VEL (RZEPPA) CV Universal Joints

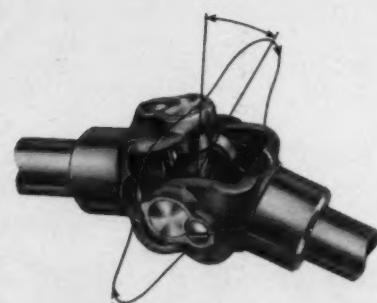
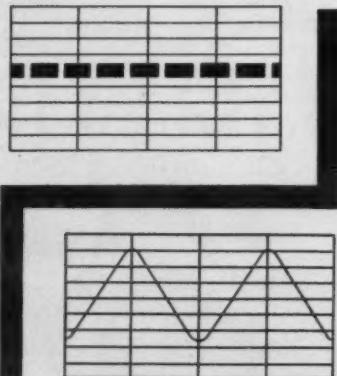
## Give Longer Life, Higher Torque Capacity!



Bell-Type CV Joint (1 1/2" to 2 1/2" axle shaft diameters) . . . designed for high-angle driving steering axles used in road building machinery • mining machinery • industrial • automotive applications



Disc-Type CV Joint (from 2 1/8" to 16 1/4" swing diameter) . . . designed for all types of industrial drive applications. Rzeppa Joints always transmit torque smoothly, even at unbalanced angles. Note constant velocity of 100% for Rzeppa Joint.



During rotation at a given angle, pin or slipper-type joints speed up, slow down twice during one revolution, as shown by the solid line in the graph.



### WRITE

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**Con-VEL DIVISION**  
DANA CORPORATION  
3901 Christopher  
Detroit 11, Michigan

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## NEW LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

### Tungsten/Moly Calculator 451

Computes weight and sizes of refractory metals. The convenient device has conversion tables for wire and rod. It also can be used as a slide calculator for rounds, squares, tubes, sheet ribbon and flat bar. The calculator uses standard density figures for tungsten and molybdenum in the wire and rod conversion tables. All wire and rod conversions are based on 19.17 g per cu cm for tungsten and 10.14 g per cu cm for molybdenum, as recommended in ASTM F290-57T. For convenience, the calculator includes a decimal equivalent table. General Electric Co., Dept. LMC-1, Nela Park, Cleveland 12, Ohio.

### Military Components Catalog 452

A listing of latest military components, including all types of military-specification potentiometers and resistors and their respective military designations. Clarostat Mfg. Co., Dover, N. H.

### Scientific Apparatus 453

Packed with hundreds of unusual and hard-to-get values in science, math and optics. Included in this 144-page data-filled catalog are measuring magnifiers, pocket comparators, illuminators, projection sets and many other instruments and components for cutting costs and speeding work. Also contained are war-surplus optical bargains, many of which are almost impossible to obtain elsewhere. Edmund Scientific Co., Barrington, N. J.

### Panel Fasteners 454

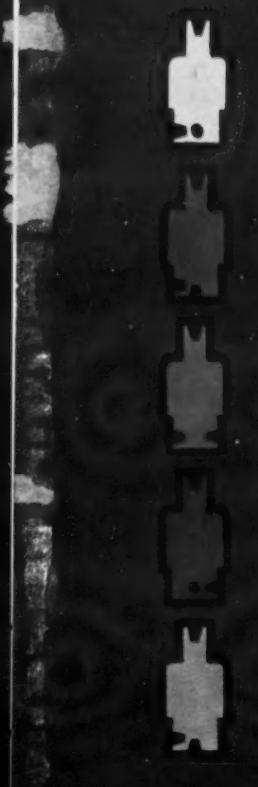
Describes self-aligning, self-locking P-series panel fastener for use in a wide variety of removable panel applications. The 6-page brochure covers features and applications, dimensional and material specifications, test data and installation methods. Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif.

### Precision Molded Parts 455

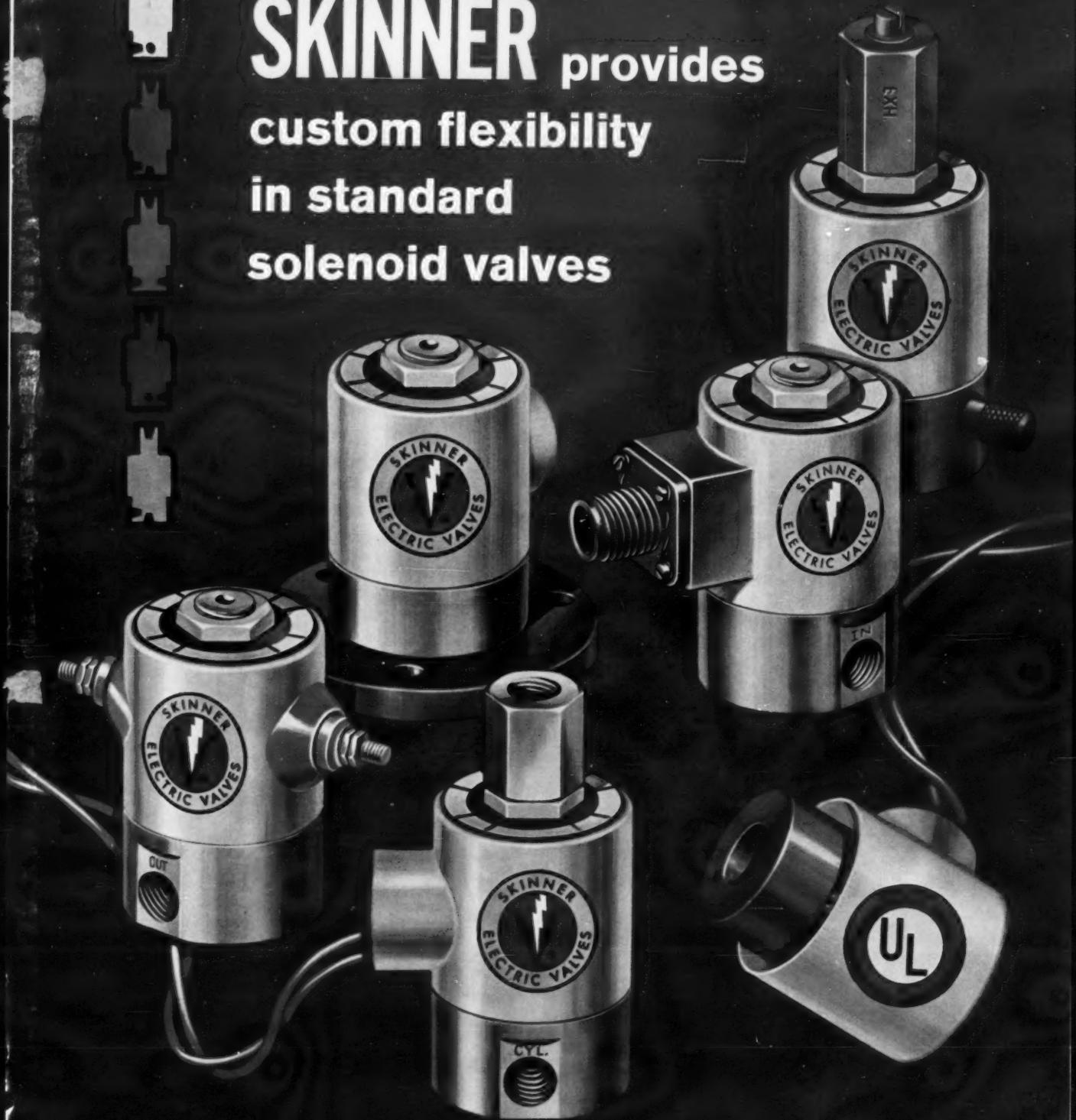
Outlines bobbin, washer and precision-made stock parts. Listed are properties of nylon, "Teflon" and epoxy materials, product illustrations and specifications on more than 500 parts. Cosmo Plastics Co., 3239 W. 14th St., Cleveland 9, Ohio.



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**SKINNER** provides  
custom flexibility  
in standard  
solenoid valves



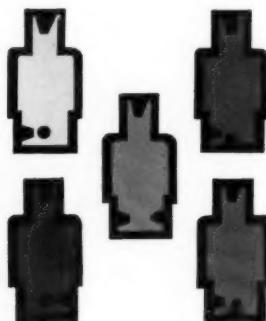
# Versatile, top quality V5, X5 line offers wide range of options

Skinner's two-way and three-way V5, X5 series of solenoid valves has earned the description—"The Universal Line." With more than 100,000 variations possible, V5, X5 valves are available for every conceivable application. And top quality is emphasized with bubbletight sealing, and stainless steel body, plunger and sleeve assembly. Precision machining, unique welding techniques, specially designed and developed machinery and manufacturing methods are all used by Skinner to produce the best valves made. These valves are small, yet handle operating pressures as high as 3000 psi. They accommodate all media that do not corrode stainless steel. And no other solenoid valves offer so many optional features. Check the following options.



## PORTING

Restrictions of installation or application, and mounting are minimized because Skinner provides a wide variety of port location options. V5, X5 valves are available with ports at right or left angles, on bottom, top, and sides for virtually all combinations of flow.



## COILS

Skinner V5, X5 valves are available with coils of many types for most DC and AC voltages at 25, 50 and 60 cycle frequencies. Whether your requirements are for continuous or intermittent performance, in tropical, high moisture or high temperature environments, or for dual voltage, Skinner UL approved coils are available with leads of several types and lengths.



When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed internationally.

# SKINNER ELECTRIC VALVES



THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION,  
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.



## ELECTRICAL HOUSINGS

Skinner offers an electrical housing for any application. Some of the most common are:

standard  $\frac{1}{2}$ " NPT conduit

grommet outlet

single or double automotive terminals

JIC housings with integral junction box

AN connector for military applications

strain relief connector for quick disconnect

All housings are steel, plated for wear and appearance, and can be rotated 360° for easy installation.

## MOUNTING

Skinner V5, X5 valves are provided with tapped holes for normal mounting, with mounting brackets for panel or other surface, or with flange for direct mounting without threaded pipe connections.

The Skinner V5, X5 series of two-way and three-way solenoid valves provides top quality design with orifices from  $\frac{1}{16}$ " to  $\frac{1}{2}$ " diameter, normally open, normally closed, dual purpose, directional control and multi-purpose, in standard and explosion-proof construction. Also included in this line is a three-way quick-exhaust type which is designed with an additional port to exhaust cylinders 4 times faster than standard types.



Typical applications—machine tools, cylinder control, instrumentation and automation of all kinds, laundry equipment, aircraft and missiles, etc. For catalogs and complete information contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

**U. S. Government  
Films**

**456**

Includes new films for science and space-age educational needs. Films and film strips listed in this catalog have been carefully selected and correlated from among more than 3000 U. S. Government-produced subjects. At low prices, they represent the finest value in audio-visual market today. Convenient order cards are enclosed for purchase and preview requests. United World Films, Inc., 1445 Park Ave., New York 29, N. Y.

**Dual Torque  
Locking Device**

**457**

Prepared for mechanical and design engineers, production executives, purchasing directors and others concerned with power transmission problems. This 22-page catalog presents a comprehensive yet concise review of a two-directional drive unit, which can be mounted to transmit driving torque efficiently, over-run, back-stop, prevent feed-back, or function in a torque-sensing capacity. Formsprag Co., 23601 Hoover Rd., Warren, Mich.

**Potentiometer Data**      **458**

Contains basic specifications such as terminal types, resistance ranges, end settings, tolerances, power ratings, operating temperatures, size and price on 13 models of trimming potentiometers. The brochure also contains cut-away drawings of basic types, illustrates outstanding features found in all models. Bourns, Inc., 6135 Magnolia Ave., Riverside, Calif.

**Specifying  
Magnesium Finishes**      **459**

This article, "How to Specify Finishes for Magnesium", discusses the availability and relative merits of chemical treatments and paints for use on magnesium. Representative costs and typical finishing systems for interior and exterior use are given. Dow Metal Products Co., Midland, Mich.

**Servomotors**      **460**

A short-form catalog which includes complete specification data on a line of 60 and 400-cycle servo units. Inertial damped servomotors and servomotor-tachometers are also illustrated in the catalog. IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, L. I., N. Y.



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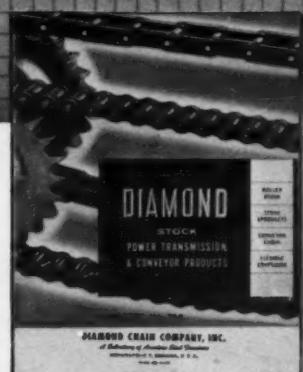
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**HIGHER HORSEPOWER RATINGS**  
mean to you . . .

**GREATER  
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**LONGER  
LIFE**

**LOWER  
COSTS**



**Write for New DIAMOND  
CATALOG No. 760**

Just off the press. DIAMOND Stock Roller Chain, Sprocket, and Coupling Catalog No. 760 gives all the new horsepower ratings. Catalog 760 also contains full data on four important new DIAMOND Roller Chain Products: *Micropitch*, *Dura-Weld* and *Tuf-Flex* chains and *Hi-Cap* flexible couplings.

**For Example:**

Former ratings for 1 inch pitch roller chain permitted sprocket speeds up to 1160 RPM, whereas the new ratings include speeds up to 2800 RPM. Similarly, rated horsepower capacities formerly did not exceed 49 HP, whereas the new ratings exceed 150 HP. New, higher ratings mean that DIAMOND roller chains are capable of more work, will last longer (thus, cost less to operate) than heretofore considered practical. You now have more opportunities to specify high-efficiency DIAMOND Roller Chain drives . . . both in new equipment designs and in modifications of existing equipment. Write today for new DIAMOND Catalog No. 760. It contains all the new ratings as established by the Association of Roller and Silent Chain Manufacturers, of which DIAMOND is a charter member.

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**ROLLER  
CHAINS** ®

## LITERATURE . . .

### Almanac and Vacation Calendar

461

An "olde fashioned" businessman's almanac and vacation calendar. In addition to standard calendar which provides space to list appointments, there are sections on the uses of office equipment and supplies; moving, shipping and storage of items; and maintaining efficiency during an office emergency. The vacation schedule includes space for listing dates and lengths of all employee vacations and the requirements of temporary workers who will substitute for them. Employers will be especially interested in the reminder of due dates for taxes in a section which lists all the necessary information for filing employee receipts, withholding taxes and social security payments. Manpower, Inc., 820 N. Plankinton Ave., Milwaukee, Wis.

### Nameplates

462

An invaluable guide to engineers, buyers, purchasing agents and others who specify anodized aluminum-foil nameplates for use on their products. This listing completely covers all aspects of nameplate design. Each sheet provides useful information pertaining to type of printing, finishes, colors, thicknesses and adhesives. Literature also gives information such as compliance to military specifications and shelf-life for foil nameplates. H. G. Dietz Products Co., 12-16 Astoria Blvd., Long Island City 2, N. Y.

### Selector Switches

463

A 4-page catalog illustrating and giving complete technical details on the series 212 (1½ inch dia) 12-position, 30-deg, indexed, rotary switches. Included are 5 photos, 13 dimensional drawings, electrical specifications, mechanical characteristics, special features and constructions, and description of a new balanced-lever arm and star-wheel detent assembly. CTS Corp., Elkhart, Ind.

### Electrical Tapes

464

"Reference Data for Design Engineers" is an easy-to-read property chart covering all "Scotch" brand electrical tapes. Designed for quick reference, chart lists typical properties, standard slitting tolerances, standard lengths and military specifications on 31 tapes, ranging from paper to silicone rubber. Listed are 9 additional sales brochures and catalogs obtainable and locations of all 3M branch sales offices. Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

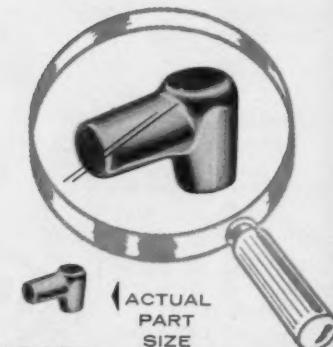
# MUELLER BRASS CO. PRODUCES SPECIFICATIONS . . . REGARDLESS OF

To obtain the desired physical and design requirements in a part at the lowest cost, there is usually one specific process by which that part can be most successfully and economically manufactured. Because the Mueller Brass Co. offers a variety of production methods, you get sound engineering, accurate production method analysis, our assurance of getting the best product at the lowest cost . . . regardless of metal specified or the size of your particular part.

## BRASS, BRONZE, ALUMINUM FORGINGS

The two parts shown here dramatically illustrate the ability of the Mueller Brass Co. to produce precision forgings regardless of size or configuration. Both the tiny dental drill nozzle and the big heat exchanger shell hub, which is the largest of its kind ever produced, were forged to exacting specifications. The weight of the nozzle is only a few ounces while the shell hub weighs 40 lbs., and has a forged pocket 7½" in diameter and 4¾" deep. By way of size comparison, the pocket is big enough to hold over 14,000 of these tiny drill nozzles.

By forging the pocket, considerable machining time and money was saved. The sound, dense structure of the shell hub makes it ideal for the high pressure application for which it was designed. The forging not only does the job better, but was produced for 25% less than the casting it replaced. Experience makes it possible for the Mueller Brass Co. to produce high quality precision forgings regardless of specifications . . . why not put this experience to work for you?



ONE DEPENDABLE



SCREW MACHINE PRODUCTS



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**MUELLER BRASS CO.**



## PARTS ECONOMICALLY...TO EXACT

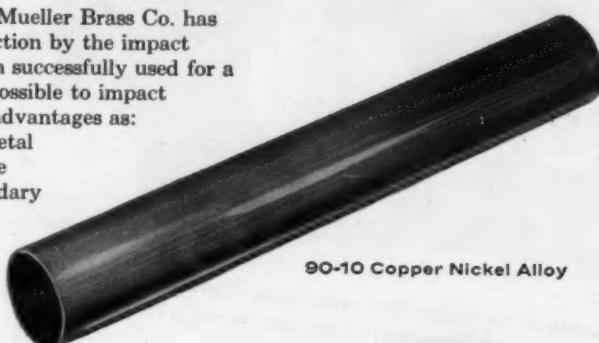
### METAL, METHOD OR SIZE...

When you are designing, specifying or purchasing fabricated parts, call in the "Man From Mueller Brass Co." to help lower costs and improve your products. Sales and engineering service is available to you at Mueller Brass Co. offices throughout the United States. Make Mueller Brass Co. your one dependable source for all your part needs.

### COLD PREST® IMPACT EXTRUSIONS

Today, because of vast experience in alloys, the Mueller Brass Co. has greatly expanded the possibilities of parts production by the impact extrusion method. Aluminum, of course, has been successfully used for a multitude of tubular shapes. But now it is also possible to impact parts of copper alloys incorporating such major advantages as: closer tolerances, better finish and appreciable metal savings. Because of dimensional accuracy possible with the impact extrusion, the necessity of secondary machining operations is often eliminated.

The parts shown here are representative of the group now being economically produced as impact extrusions by the Mueller Brass Co. who offer complete engineering and design service in the development of new parts from copper base alloys.



90-10 Copper Nickel Alloy



Special Alloy 902

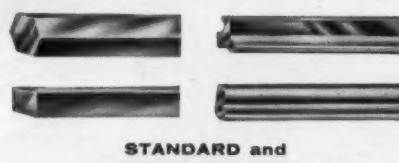


Tellurium Copper Alloy



Low Phosphorus Copper Alloy

### SOURCE FOR ALL THESE OTHER PRODUCTS



319

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### Nylon Fasteners Specifications

465

Standard specifications for nylon molded threaded fasteners. These specifications cover the six head types available for nylon machine screws: round, binding, oval, washer, flat and fillister; and the six point types available for nylon headless set screws: plain, oval, cone, flat, half dog and full dog. Sheet gives complete details on threads and principal dimensions for all head types. Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.

### Servo Amplifier Catalog

466

A 16-page illustrated catalog comprising major products in a servo amplifier line for both military and industrial applications. The catalog is comprehensive and includes specifications and application data for: push-pull saturable transformers; all-magnetic and transistor magnetic amplifiers; miniaturized amplifiers; and a new line of transistor servo amplifiers. Engineers will find valuable technical information on magnetic amplifier theory, servo applications data on closed-loop single and two-speed systems and a special section on servomotor-amplifier combinations for units ranging from 5 to 2500W. Magnetic Amplifiers Div. of Siegler Corp., 632 Tinton Ave., New York 55, N. Y.

### Inspection Lights

467

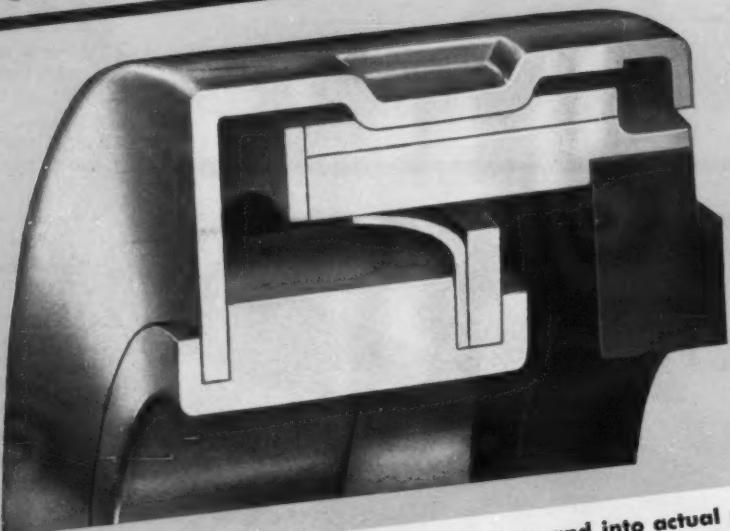
A bulletin describing and illustrating 12 types of inspection lights. Included are direct types for surface or interior inspection, prefocused and adjustable-focus lights, lights combined with magnifying lenses, lights with rotatable mirrors for right-angle vision in relatively large bores, and borescopes for right-angle vision in small bores. Also covered are conventional and rechargeable battery handles and transformers to power these lights, and a separate listing of 15 styles of miniature lamps with their electrical characteristics and dimensions. Welch Allyn, Inc., 168 Jordan Rd., Skaneateles Falls, N. Y.

### D-C Electric Timing Motor

468

A complete description of the Series MD-83 direct-current timing motor is available in this illustrated folder. The literature gives details on construction features and the resultant operating advantages of this device. Dimensional data drawings and complete information on ratings and availability of components are also listed. Haydon Div. of General Time Corp., 245 E. Elm St., Torrington, Conn.

# NEW Seals at $-65^{\circ}$ to $+850^{\circ}$ F.



Now beyond the Research-Development Laboratory and into actual production — nothing like it on the market! Consider these exclusive design advantages, producing a built-in "missile reliability":

- 1 Hydraulic balance producing optimum sealing under both static and dynamic conditions — not always available in other all-metal seal designs.
- 2 Functions at temperatures, pressures and speeds in excess of capabilities of currently used organic materials — in minimum space required by aircraft-missile applications.
- 3 No internal fatigue. All components, except seal face, are made of various high-temperature alloy steels, each with the optimum combination of properties necessary to its function. (Exclusive Gits design makes Met-L-Seal operable at temperatures even higher than  $850^{\circ}$ , limited only by metallurgical progress in high-temperature alloy steels.) Positive guarantee against sudden complete operational failure and other drawbacks of synthetic-elastomer seals in extreme operating conditions.
- 4 No "shelf life" problems. No "cure-date" limitations as are necessary with synthetic-elastomer seals.

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all stainless steel construction with carbon graphite or exotic alloy face materials

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Specialists in Lubricating Devices and Shaft Seals for Almost Half-A-Century

## LITERATURE . . .

### Motor Selection Guide 469

Designed to assist motor users, resellers and specifiers in selection of suitable motors from  $\frac{1}{2}$  to 10,000 hp. Outlined are a-c induction motors, either low or high slip for normal or troublesome loads. A number of mechanical variations are shown in this catalog. Also included is a section on constant speed, unity power factor synchronous motors, in horizontal or vertical construction. Fairbanks, Morse & Co., Electrical Div., 303 N. Henderson, Freeport, Ill.

### Silicone Coatings 470

A 16-page publication is available discussing silicone coatings for paper release. Designated CDS-270, this informative bulletin deals with a description of various applications of silicone release coatings as well as chemistry of these materials. Publication is illustrated with more than 20 photographs, tables and charts, providing valuable data on the subject. General Electric Co., Silicone Products Dept., Waterford, N. Y.

### Armature Wedge Comparison Chart 471

An illustrated, easy-to-read chart comparing more than a dozen different motor and armature slot wedging materials. This chart compares properties such as heat resistance, ease of insertion, tolerance and cost on one side of this single-page bulletin, and illustrates wedges on the other, some standard and some special. Insulation Manufacturers Corp., Inmanco Div., 565 W. Washington Blvd., Chicago 6, Ill.

### 200 PSI Air Cylinder 472

Provides concise engineering data and specifications on a maximum 200 psi series "S" midget air cylinder. Both universal mounting and nose mounting models in  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $1\frac{1}{2}$  inch bore sizes with standard strokes to 12 inches are fully described. A cut-away diagram points out internal and external features of this compact, small-force unit. Hannifin Co., Dept. 594, 501 S. Wolf Rd., Des Plaines, Ill.



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# RESERVED FOR ENGINEERS CONCERNED WITH DESIGNING SAFE-DURABLE- FLEXIBLE LINES

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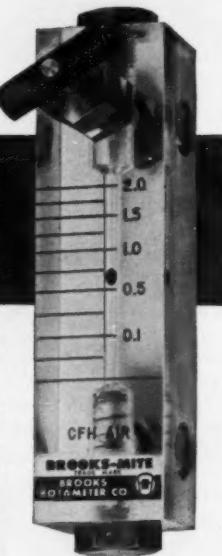
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## SMALL FLOW INDICATOR

NEW BROOKS-MITE DESIGN...  
RUGGED...AT LOWEST COST

Here's the well-known BROOKS-MITE Flow Indicator with the new "O" ring construction. Torque limitations of the past are overcome. This is your best meter where rugged service and need for lowest possible cost go together.

The BROOKS-MITE has an acrylic plastic meter body and is available in 24 flow ranges. Optional features include a built-in FLO-MITE needle valve and integrally piped constant differential relay.



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DESIGN NEWS—JANUARY 16, 1961

## Screw Conveyor Engineering Guide 473

An informative, information-packed 150 pages. This guide contains several pages showing typical installations of screw conveyors. Three chart and art-filled sections on engineering, components and layouts cover 83 center pages. Thomas Conveyor Co., Dept. 506, P. O. Box 11127, Fort Worth, Tex.

## Zener Protection Circuit Applications 474

Titled "Zener Protection Circuits for Aircraft Voltage Surges", this 4-page publication includes circuit schematics, performance curves and a nomograph showing quantity of zeners needed. A total of 8 illustrations supplement text, making publication valuable to circuit designer. Technical Information Center, Motorola Semiconductor Products, Inc., 5005 E. McDowell Rd., Phoenix, Ariz.

## Electrical Insulations 475

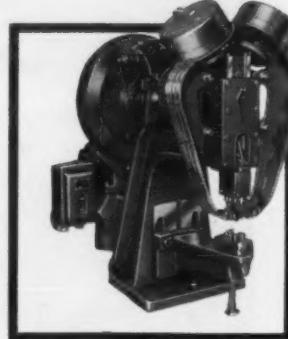
Describes coated glass fabrics for electrical applications. The publication illustrates uses for coated glass fabrics, which combine specially formulated high-temperature varnish or resin coatings and inorganic woven glass fabrics with a wide range of electrical and mechanical properties. Applications are shown, including hand wound and stick wound transformer coil insulation, heavy-duty transformer coil insulation and motor end turn coil insulation. Irvington Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

## Lubricants 476

A 4-page brochure describing extreme-pressure anti-scoring lubricants. Product uses are described for lubrication in such operations or equipment as lathe centers, steady rests, thrust bearings, broaching, extruding, swaging, die-set posts, cams, machine ways and tapping. Chicago Mfg. & Distributing Co., 1908-K W. 46th St., Chicago 9, Ill.



## United Eyelets and Eyeleting Machines Keep this Princess on Constant Call



The new Princess telephone — a product of the Western Electric Company — is an achievement in communication design INSIDE as well as out, thanks in part to a United Eyeleting Machine that automatically feeds and sets six twin United Eyelets in a plastic insulating terminal board no bigger than a cigarette lighter.

Accurate alignment of the setting bar and an especially rigid frame — unique with the Model F United Eyeleting Machine — brings uniform pressure to bear on all six twin United Eyelets scattered over a broad pattern range.

If you want faster production using greatly simplified setups of multiple mechanisms plus absolute reliability in multiple eyelet patterns, call or write your nearest United sales office.

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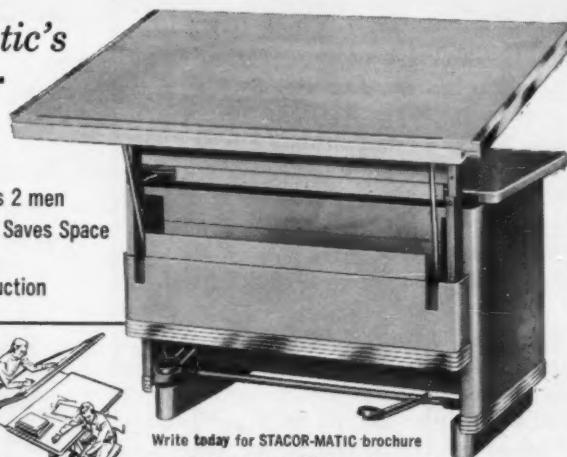


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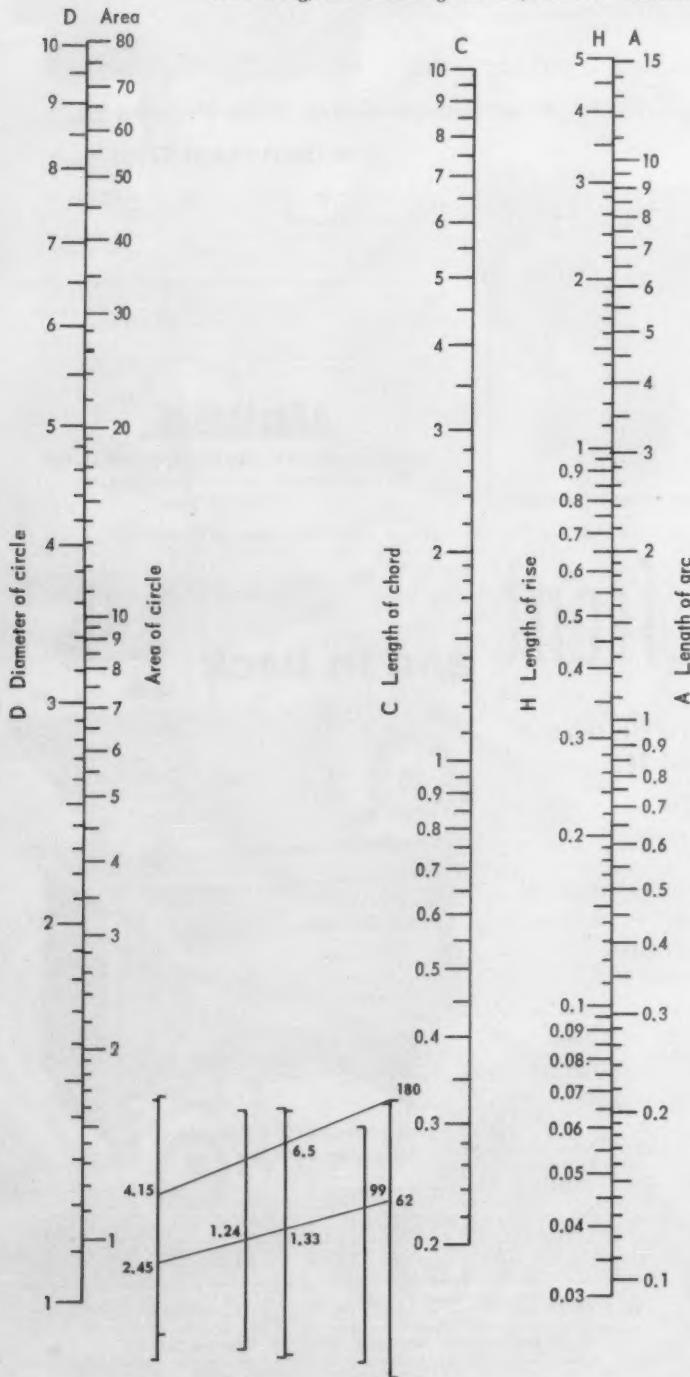
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## Nomogram for Properties of the Circle

B. L. Wong, Manufacturing Planner, Lockheed Aircraft Corp., Sunnyvale, Calif.



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## A NEW SERIES OF KNOBS for TODAY'S INSTRUMENTS

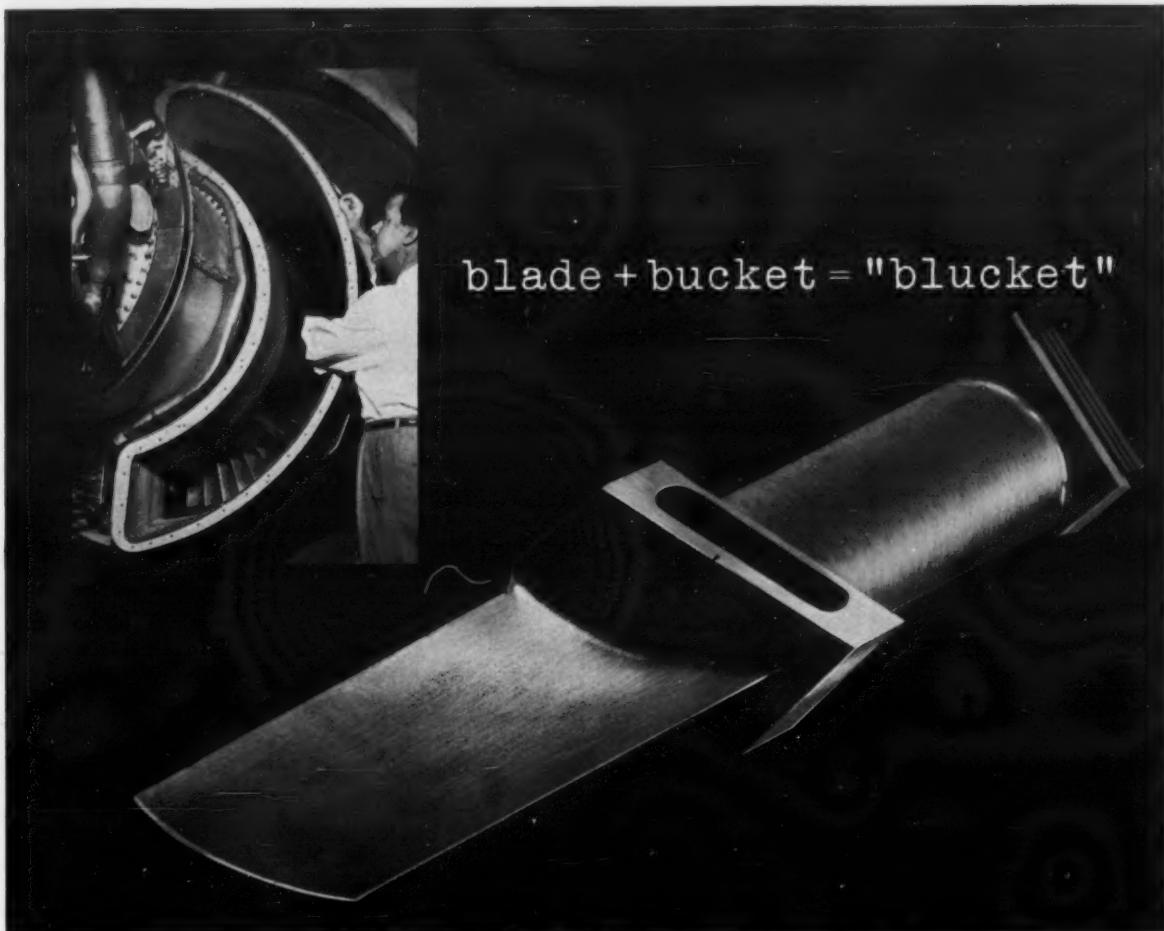


Especially designed to fill the multiple requirements on modern instrumentation. This new series (4 basic sizes plus a dual control) is shown in actual size. Write for FREE, complete catalog illustrating standard plastic parts available without tooling costs. Samples on request.



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MOLDING COMPANY**  
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blade + bucket = "blucket"

## new design in Carpenter high temperature alloy V-57

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V-57 is the super alloy now used to forge this unique new jet engine component. V-57 replaced A-286 (originally used) because of its superior mechanical properties at operating temperatures. Like all Carpenter vacuum melted metals, V-57 is produced with exclusive Carpenter quality controls that permit tighter forging tolerances, better machinability and improved cold forming properties.

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DESIGN NEWS—JANUARY 16, 1961

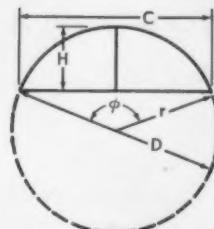


Fig. 1

It is frequently necessary to calculate various segments or elements of a circle. The calculations are not difficult, but troublesome, for there are lengthy multiplications and trigonometric functions involved. This nomogram simplifies the calculating processes.

From Fig. 1, the following equations can be derived:

$$A = 0.008726 D \phi \quad (1)$$

$$C = D (\sin \phi/2) \quad (2)$$

$$H = D/2(\tan \phi/4) (\sin \phi/2) \quad (3)$$

Where:

A = arc

C = chord

H = rise

D = diameter of any circle

φ = angle in degrees.

Example 1:

Find the length of the arc subtended by a central angle of 62 deg if the diameter of the circle is 2.45 inches.

Align  $\phi_A = 62$  deg with D = 2.45 inches and read A = 1.33 inches.

Example 2:

Determine the length of the chord subtended by a central angle of 61 deg if the diameter of the circle is 2.45 inches. With the same alignment as in Example 1 ( $\phi_A = 62$  deg, D = 2.45 inches and  $\phi_C = 61$  deg), read C = 1.24 inches.

The rise is 0.43 inch on the H scale if the angle is 99 deg and the circle is of the same diameter.

Note that the D scale can be extended to any diameter, provided a suitable factor is used to reduce the numerical value to that within the scale and the result is multiplied by the reciprocal of the factor.

The nomogram can be used to determine circumference of any circle. Because the length of the arc subtended by 180 deg is equal to half the circumference, align 180 deg on the  $\phi_A$  scale and the diameter on the D scale and double the reading on the A scale. (Example: The circumference of a circle of 4.15 inches diameter is (6.5) (2) = 13 inches.)

The area for any circle up to 10 inches in diameter is given opposite the D scale. For a circle with a diameter greater than 10 inches, reduce the diameter by a factor and multiply the value found on the "area" scale by the square of the reciprocal of the factor.

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## DESIGN DATA...

### Stresses In Thick-Walled Spheres

F. Caplan, Kaiser Engineers, Oakland, Calif.

#### Internal Pressure

The maximum circumferential (hoop) stress, tensile or compressive, of a thick-walled sphere under internal pressure only, occurs at the inner surface and is given by:

$$S = \frac{P}{2} \left[ \frac{b^3 + 2a^3}{b^3 - a^3} \right]$$

Where:

P = uniform internal pressure, psi

b = outside radius (or diameter), inches or feet

a = inside radius (or diameter), in the same units as b

Nomogram I is a graphical solution of this equation. Note that if both b and a are multiplied by any number, the value of S remains unchanged.

Example: What must be the inside radius of a 10-inch OD spherical accumulator subjected to 8500 psi internal pressure if the maximum circumferential stress shall be no more than 22,000 psi?

Align S = 22,000 with P = 8500, intersecting the reference line. Align this intersection with b = 10 and read a = 8.35 inches ID, or 4.175 rad.

#### External Pressure

The maximum compressive stress of a thick-walled sphere under external pressure occurs at the inner surface and is given by:

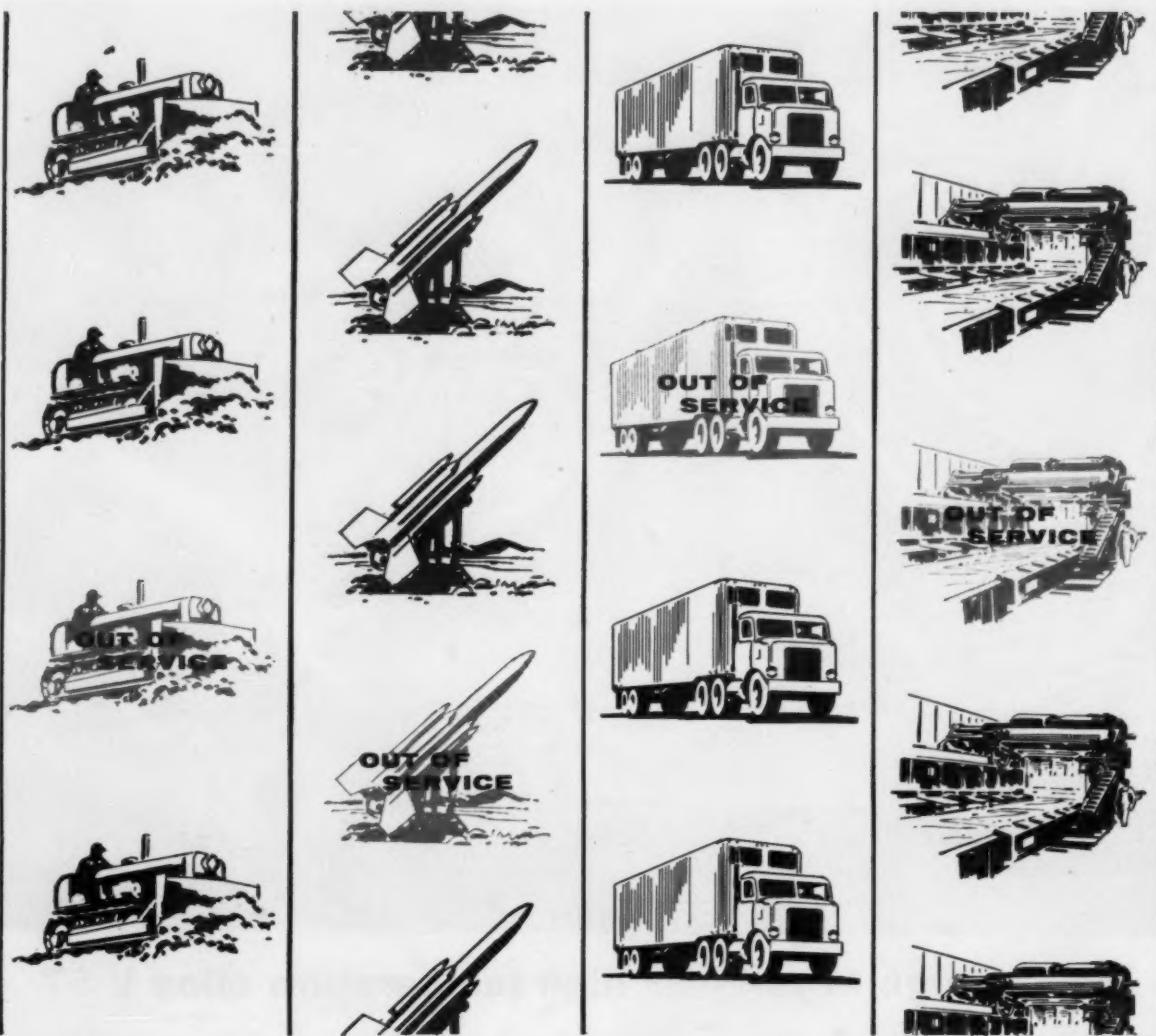
$$S = \frac{3}{2} \left[ \frac{P b^3}{b^3 - a^3} \right]$$

Nomogram II is a graphical solution of this equation.

Example: If 20-inch OD, 16.7-inch ID sphere is subjected to 6100 psi external pressure, what is the maximum compressive stress?

Align b = 20 = (2) (10) with a = 16.7 = (2) (8.35), intersecting the reference line. Align this intersection with P = 6100 and read S = 22,000 psi.

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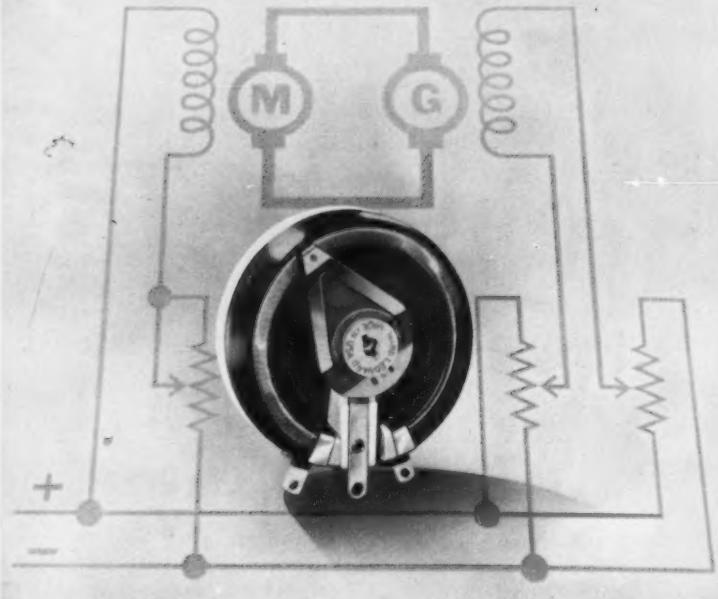
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Background is schematic of world-famous Ward Leonard system of control.

## In modern rheostat circuits, it's SERVICE CONTINUITY THAT COUNTS

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That's the black picture when an industrial control component—specifically a rheostat—fails. That's why reliability is more important than initial cost. In many cases, these irrecoverable charges and costs can quickly far exceed the replacement cost of the faulty components.

And that's why far-sighted designers are more and more specifying Ward Leonard VITROHM ring rheostats for control circuits where performance is a must...in motor and generator field control circuits...for electronic tube filament circuits...wherever substantial amounts of power must be handled with utmost rheostat reliability.

Ward Leonard ring rheostats, in sizes of 25, 50, 100, 150 and 300 watts, feature W/L's exclusive "twin contact shoe" design. Two sintered, self-lubricating contact shoes minimize wear and assure uniform contact pressure, smooth oper-

ation, and maximum reliability.

Special alloy resistance wire—made to W/L's closely monitored specifications to assure highest stability and lowest practical temperature coefficient—is bonded permanently to ceramic core by Ward Leonard's own VITROHM vitreous enamel.

These are just a few of the reasons why VITROHM ring rheostats give you outstanding reliability in industrial control circuits. There are many more quality-engineered features than we can describe here—for instance, highest grade ceramic base and core, durably bonded tinned alloy terminals, and balanced beryllium copper contact arm. You'll find them all in Bulletin 60RR (and for powers above 300 watts, check W/L plate rheostats in Bulletin 60A). For your copy, and for a list of stocking distributors, write: Ward Leonard Electric Co., 26 South St., Mount Vernon, N.Y. (In Canada: Ward Leonard of Canada, Ltd., Toronto.)



**WARD LEONARD**  
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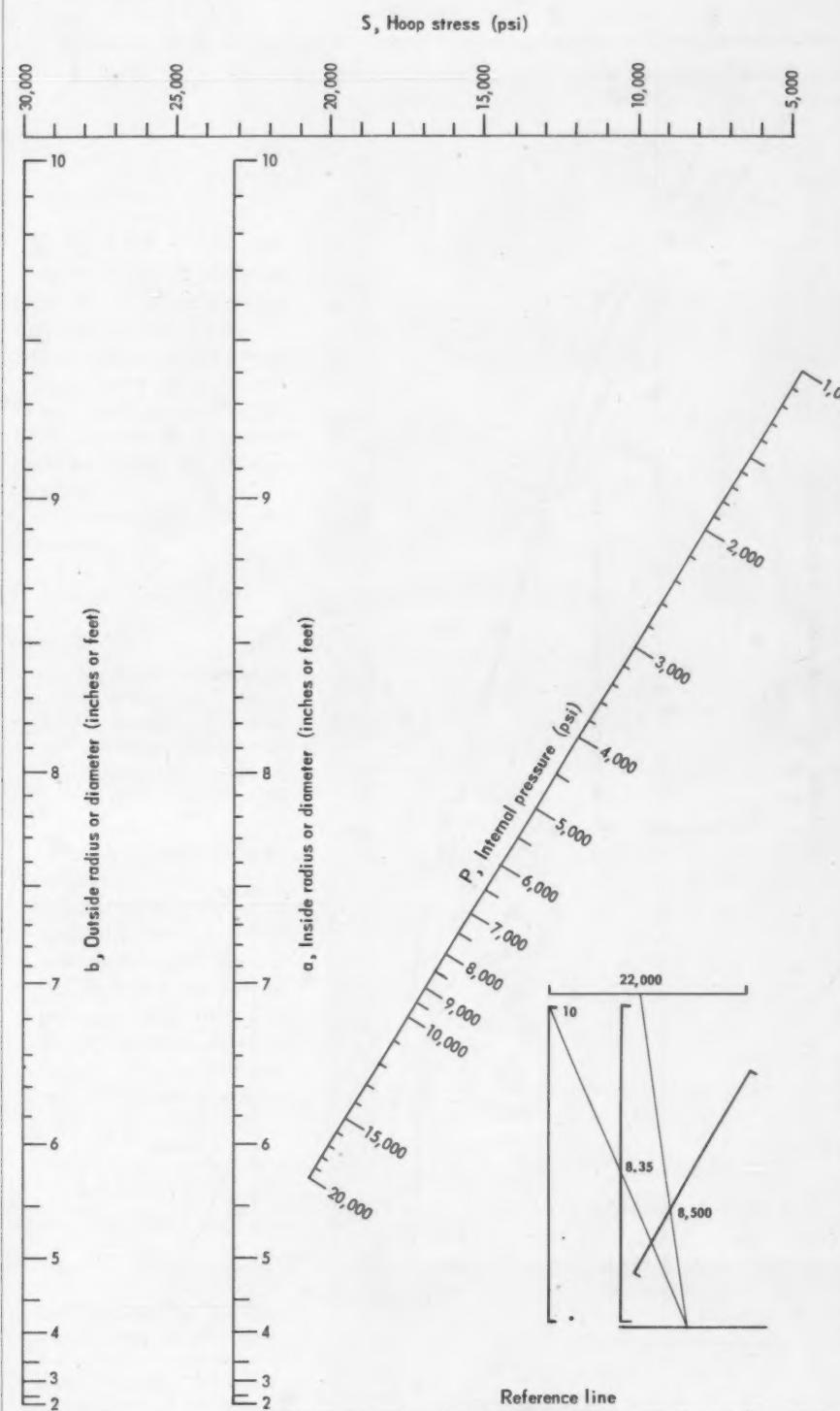
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NOMOGRAM I

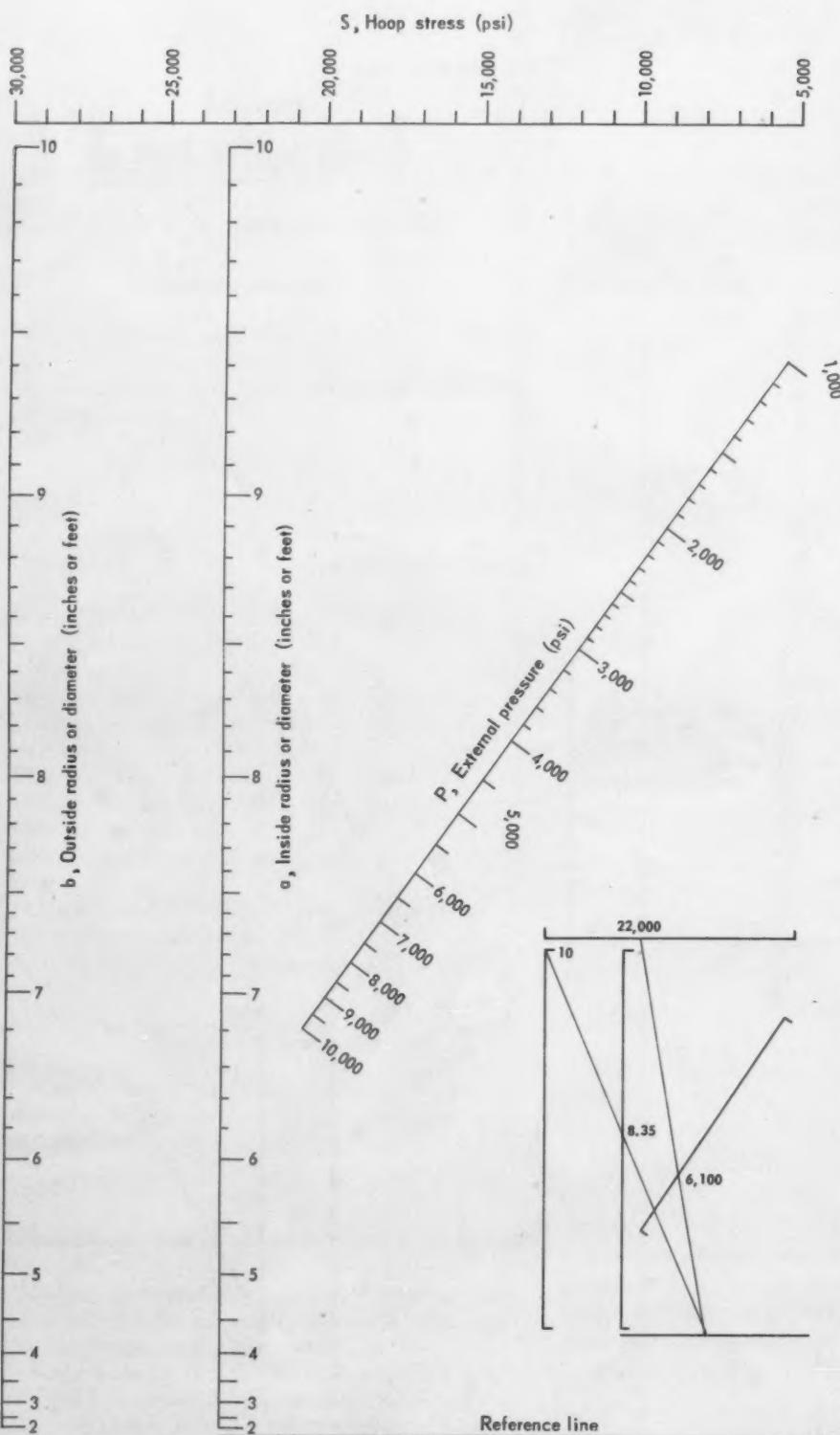


(Continued on next page)

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**Thick-Walled Spheres . . . Cont.**

NOMOGRAM II



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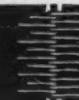
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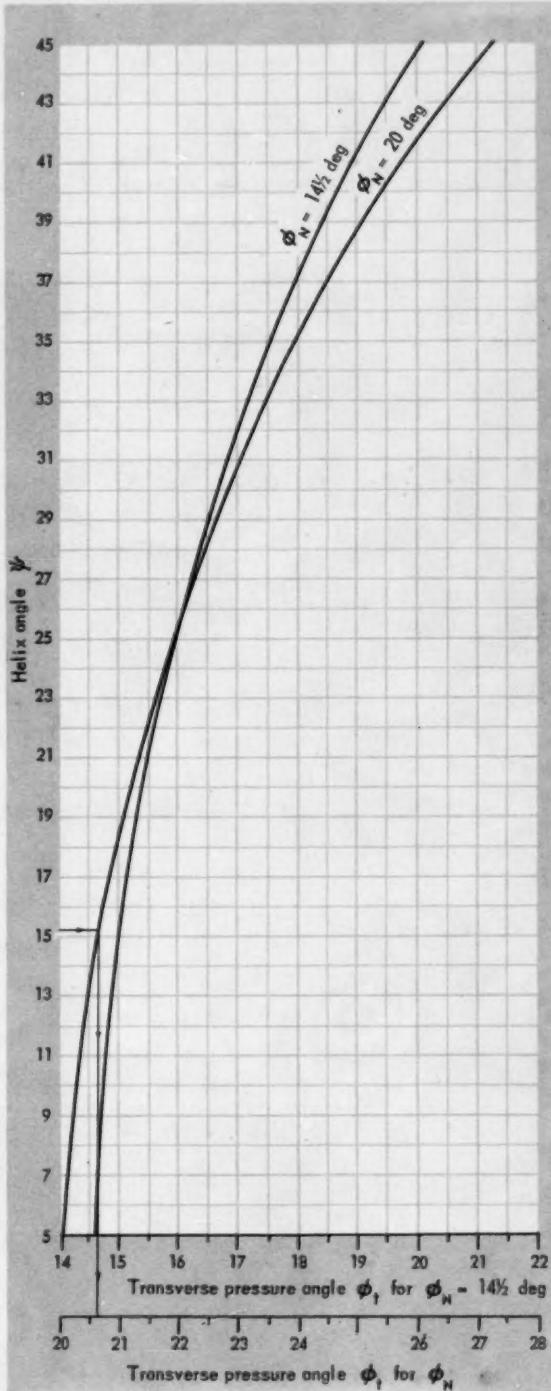
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## Nomogram for Transverse Pressure Angles of Helical Gears

J. I. Schwartz and D. C. Thomson, U. S. Naval Engineering Experiment Station, Annapolis, Md.



This nomogram is useful in gear stress calculations. It may also be used in the design of drills, compressors, pumps, screw threads and in any other area where the determination of transverse pressure angles of helices is necessary.

The nomogram solves the equation:

$$\tan \phi_t = \frac{\tan \phi_N}{\cos \psi}$$

Where:

$\phi_t$  = transverse pressure angle

$\phi_N$  = normal pressure angle (14½ or 20 deg)

$\psi$  = helix angle or 90

-λ

λ = lead angle of helix

Example:

If  $\phi_N = 20$  deg and  $\psi = 15.20$  deg, find  $\phi_t$ . Draw a horizontal line from  $\psi = 15.20$  to the 20-deg pressure angle curve. At the intersection, draw a vertical line to the correct horizontal axis and read  $\phi_t = 20.65$  deg.

*The opinions or assertions made are those of the authors and are not to be construed as official or reflecting the views of the Department of the Navy or the Naval Services at large.*

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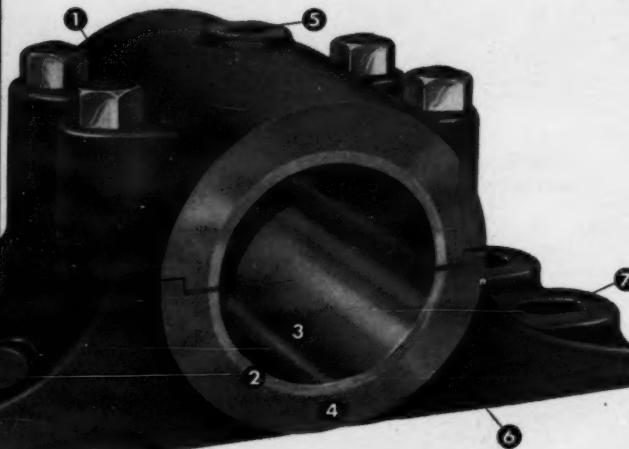
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## TECHNICAL PAPERS

### A Blade Design Method For Axial Flow Turbines

F. Baumgartner and R. Amsler,  
Boeing Airplane Co.

#### NOMENCLATURE

$r$ = radial coordinate	ft
$z$ = axial coordinate	ft
$\Phi$ = angular coordinate	radians
$y = r$ circumferential coordinate	ft
$\omega = \frac{d\Phi}{dt}$ angular velocity	radians/sec
$V_u = r\omega$ circumferential velocity	f.p.s.
$\alpha = \frac{d\omega}{dt}$ angular acceleration	radians/sec <sup>2</sup>
$r\ddot{\omega} = \frac{dV_u}{dt}$ circumferential acceleration	ft/sec <sup>2</sup>
$U$ = circumferential velocity of rotor blades	f.p.s.
$V$ = absolute flow velocity	f.p.s.
$W$ = flow velocity relative to moving blade	f.p.s.
$p$ = pressure	lb/ft <sup>2</sup>
$\gamma$ = specific weight	lb/ft <sup>3</sup>
$\rho = \frac{p}{\gamma}$ specific mass	slugs/ft <sup>3</sup>
$g = 32.2$ gravity acceleration	ft/sec <sup>2</sup>
$J = 778$ work-heat-equivalent	ft lb/Btu

#### SUBSCRIPTS

0	nozzle inlet
1	nozzle exit — also rotor inlet
2	rotor exit
s	static pressure
t	total pressure
rel	relative to moving blades
r	radial direction
u	circumferential direction
z	axial direction

#### Introduction

Early in the development program for small gas turbines, undertaken by the authors' company, the need was recognized for a consistent method to determine blade shapes in turbines and compressors of axial and radial flow types. The method had to define the correct blade shape uniquely for any given application. It had to be clear and simple enough to permit the turbine designer to evaluate the basic problems without applying complicated mathematical procedures or experience factors. It appeared to be desirable to combine experimentally determined blade-design information with a simple mathematical formulation of the flow problem to obtain a clear picture of the flow pattern.

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# ANNOUNCING

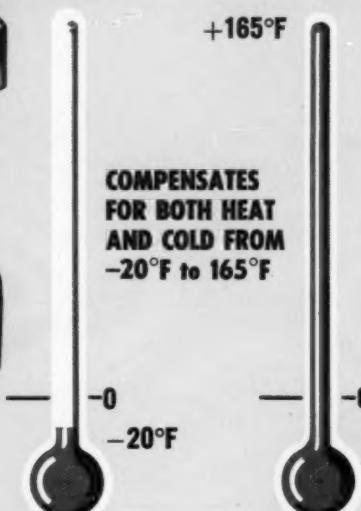
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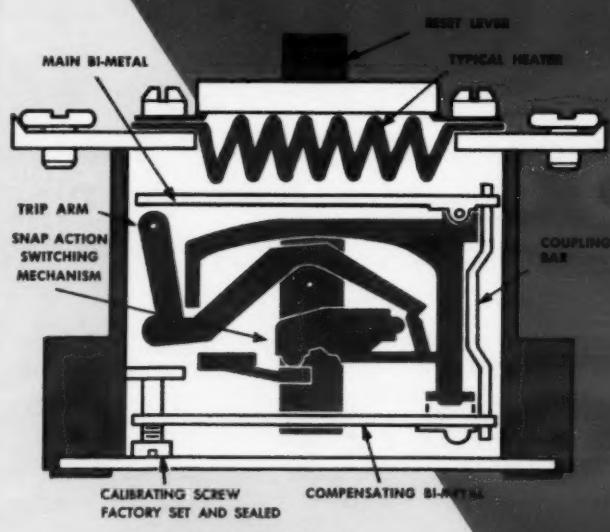
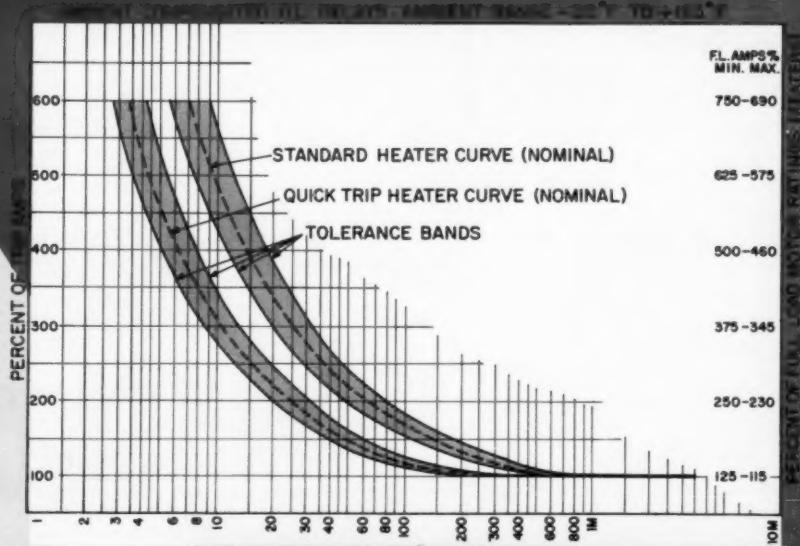
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Description of Method

The basic design parameters must be established. First, the flow rate must be determined, based on power output, turbine inlet conditions, turbine exit conditions and expected overall stage efficiency. Next, an appropriate flow pattern is selected. For theoretical considerations, a free-vortex flow pattern usually is selected. In a free vortex the tangential velocity components of the stream particles are inversely proportional to their radial distance from the centerline; the axial velocity components are constant across the whole flow area. A free-vortex flow pattern is maintained across the rotor if equal amounts of work are taken out at any radius station.

The degree of reaction that can be built into the turbine stage is dictated to a large extent by stress considerations. The best compromise between high power output per stage and high efficiency usually is obtained by designing for about 15 to 20 percent reaction at the blade root station. This yields about 50 percent reaction at the blade tip station.

Velocity diagrams usually apply to a mean stream line, located about halfway between two adjacent blades. In the immediate vicinity of the blades, the flow directions will vary to some extent from those of the mean stream line. The deviations of the concave side of the flow boundary from the mean stream line at entrance and exit are defined respectively as angle of incidence

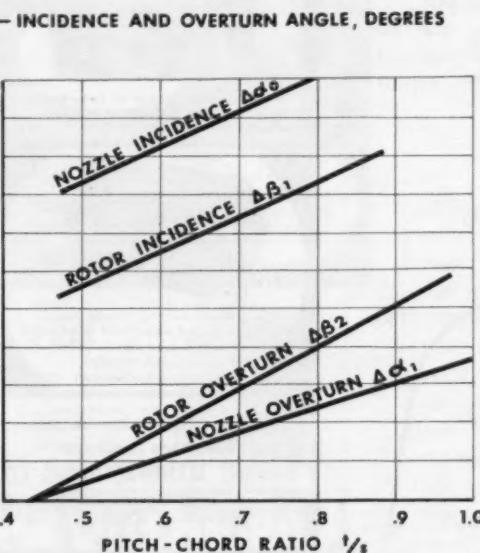


Fig. 1

(Continued on next page)



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## TUTHILL PUMPS Lubricate GARDNER-DENVER'S RP-900 Compressor



Gardner-Denver describes its new model RP-900 as "the finest rotary compressors on the market". Developed for operation under the most extreme climatic conditions the new units are designed to provide the greatest possible dependability in the roughest service.

Essential to the RP-900's dependable performance is its lubricating oil pump. Gardner-Denver selected Tuthill to work with its engineers in developing a unit which would provide positive and metered oil-flow to assure lubrication, cooling and sealing under all operating conditions.

Tuthill's standard pump 5C, especially modified to meet the demands of this particular application, was selected. Adapted for operation at 1800 rpm, the Tuthill unit is mounted directly on the compressor rotor shaft. Special mounting brackets and shafts, developed by Tuthill's engineers, facilitate assembly and maintenance of the compressor.

Tuthill manufactures a complete line of positive displacement rotary pumps with capacities from  $\frac{1}{8}$  to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.



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### Blade Design . . . Cont.

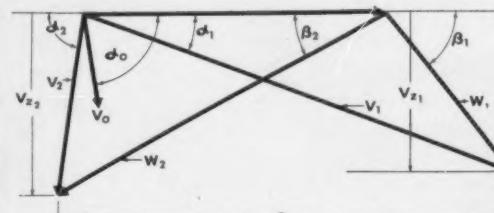


Fig. 2

and angle of overturn. Fig. 1 gives typical design values as function of pitch-chord ratio.

It is convenient to arrange the velocity diagram as shown in Fig. 2, where the total velocity change in tangential direction across the rotor blades is represented by a single vector B. Vector B, together with the flow rate, determines the momentum change in the rotor and fixes the torque which the gas exerts on the rotor.

If the velocity diagram (Fig. 2) were used directly, a blade would result that would provide neither an incidence angle at the inlet nor an overturn angle at the exit. To remedy the situation, a corrected velocity diagram is drawn up that takes into account an overturn angle. Vector B is increased, which means that a larger momentum change is used for the blade design than is needed to satisfy the required power output.

Cascade tests have shown, however, that any given blade chord can be utilized most effectively if the blade loadings are increased fairly rapidly

#### BLADE LOAD COEFFICIENT, $\Phi$

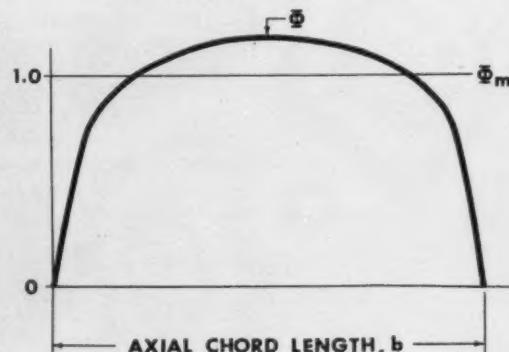


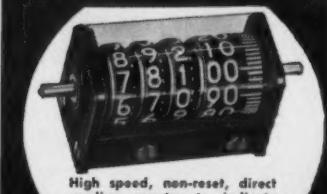
Fig. 3

**DURANT**

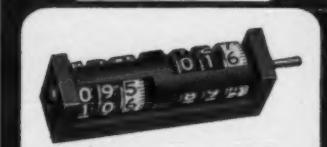
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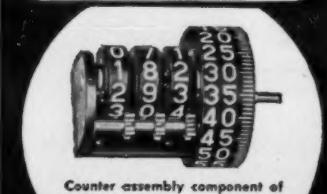
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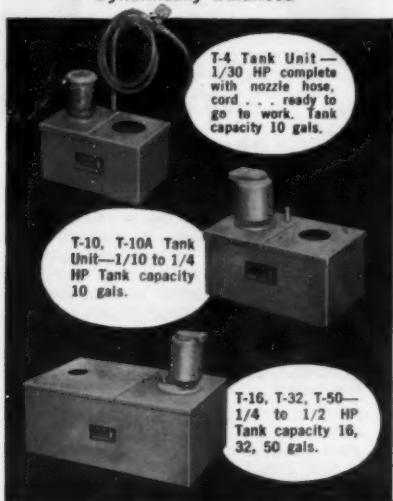
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near the inlet by means of a certain incidence angle. This practice results in more uniform blade loadings across the whole blade chord. Fig. 3 shows a desirable blade load distribution for an axial flow type blade. Figs. 4 and 5 show modified velocity diagrams for nozzles and rotor blades, respectively.

To determine the airfoil shapes of the blades, differential equations for three-dimensional compressible flow are simplified as follows:

$$\frac{\partial p}{\partial r} = \rho r \omega^2 \quad (1)$$

$$-\frac{\partial p}{r \partial \Phi} = \rho \frac{d\omega}{dt} r \quad (2)$$

$$-\frac{\partial p}{\partial z} = \rho \frac{dV_z}{dt} \quad (3)$$

Equation (1) expresses radial equilibrium and may be used to calculate the fluid density at any radius station. Equation (2) is used to calculate the blade shape. Equation (3), in conjunction with (1) and (2), provides a means for checking the density changes of the gas as it passes through the blades.

Flow rate, gas densities and velocity pattern determine the required flow areas. A first approximation of flow annulus dimensions and wheel

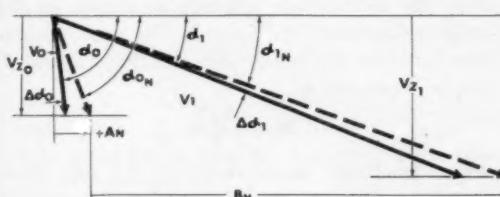


Fig. 4

configuration can be made as shown in Fig. 6. The blade chord length is selected so that satisfactory wheel proportions are obtained. The blade spacing is selected such that pitch chord ratios below 1 are obtained at the outer diameter of the flow annulus. The main feature of the present blade design method consists of selecting a suitable airfoil and shaping it into a blade profile such that momentum requirements are satisfied, together with requirements of optimum blade load distribution, flow rate and stress.

Start out by selecting a basic airfoil suitable for operation at high subsonic velocities. This airfoil is then shaped into a blade profile such that the tangents to the concave face of the blade satisfy the modified velocity diagram. Fig. 7 shows typi-

(Continued on next page)

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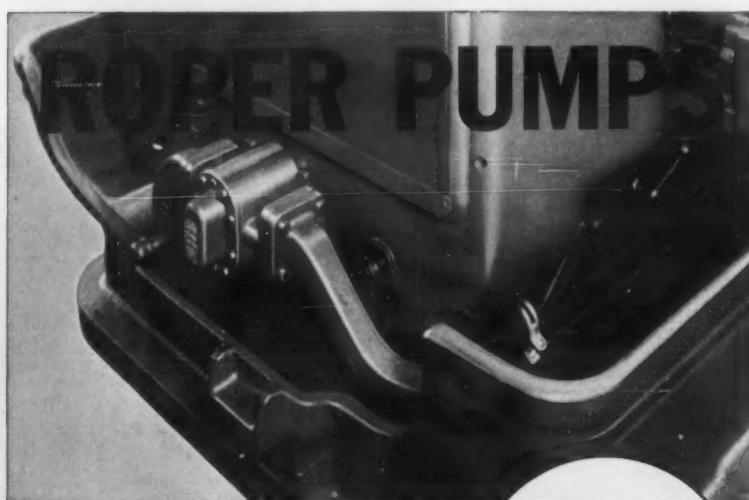
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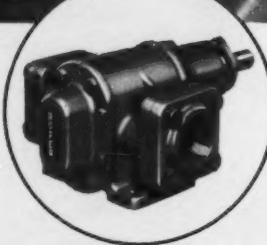
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### Blade Design . . . Cont.

cal rotor blade profiles that are obtained with this approximation method. The preliminary wheel configuration should be used for a careful stress study to avoid the need for major changes later, after the blade profiles have been calculated in detail.

The concave side of the blade profile is checked according to equation (2), which can be rewritten as follows:

$$-\frac{\partial p}{\rho r \partial \Phi} = \frac{d\omega}{dt} r = \frac{dV_u}{dt} = \frac{dV_u}{dz} \frac{dz}{dt} = V_z \frac{dV_u}{dz}$$

The pressure gradient  $-\frac{\partial p}{r \partial \Phi}$  between two adjacent blade surfaces may be assumed to be constant. Therefore, it can be replaced by a constant  $\frac{q}{C}$  where  $q$  represents the blade load or the pressure difference between the two blade surfaces and  $C$  is the distance between the two blade surfaces.

Solving for  $dV_u$  we find:

$$dV_u = \frac{qdz}{C\rho V_z} \quad (4)$$

This is the differential velocity increase in circumferential direction over a blade length increment  $dz$  measured in axial direction for a given blade load  $q$ .

The blade load  $q$  must now be determined from the momentum changes as shown in the velocity diagrams Figs. 4 and 5. The total momentum force on the blade area  $bh$  (Figs. 6 and 7) can be expressed as:

$$Q = \frac{fmB}{g}$$

where  $fm$  is the mean flow rate for one blade passage and for unit blade height  $h$ . The velocity change  $B$  may be obtained from Fig. 4 for the nozzles and from Fig. 5 for the rotor.

The mean flow rate  $fm$  can be calculated from the inlet and exit conditions of the blade. Because of centrifugal forces the flow lines are crowded toward the outside in regions of high

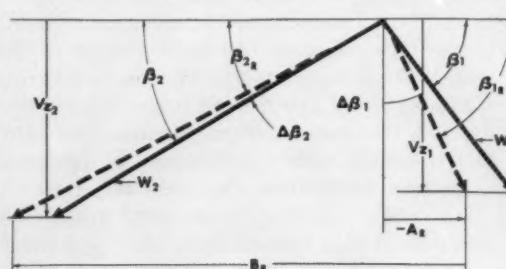
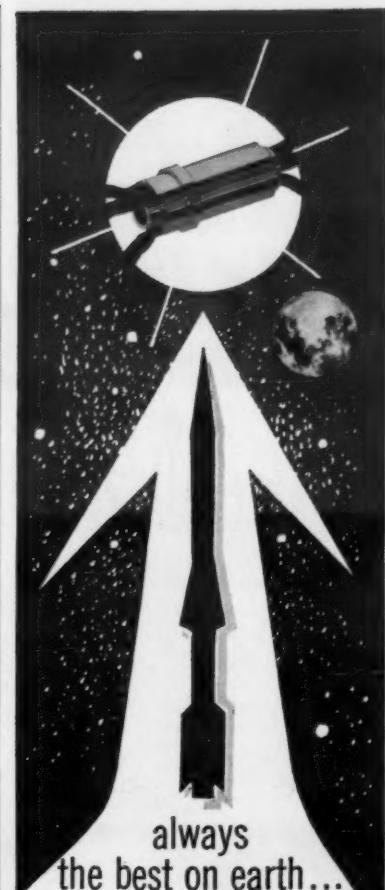


Fig. 5



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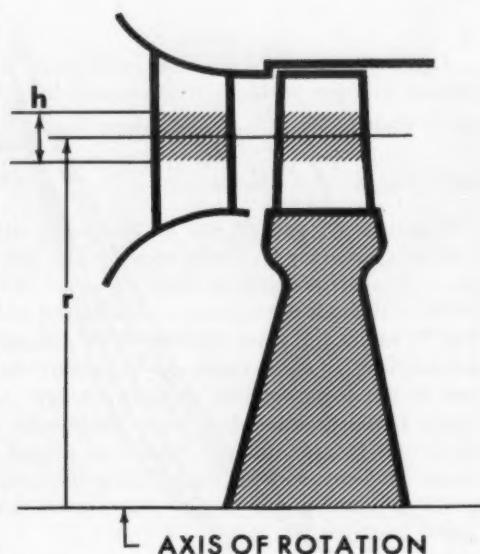


Fig. 6

circumferential absolute gas velocities. When the gas flows in purely axial direction, the flow lines are spaced uniformly. Because of this slight radial displacement of the stream lines which is caused by changes in flow direction, the flow rate  $f$  varies as the gas flows through the blades. A mean value of  $f$  for any given radius station can be calculated as follows:

$$f_m = \frac{f_1 + f_2}{2}$$

where:  $f_1 = V_{z1} \gamma_1 C_1 h$   
and:  $f_2 = V_{z2} \gamma_2 C_2 h$

The mean blade load for a given radius station can be expressed as:

$$q_m = \frac{Q}{bh} \frac{f_m B}{gbh} \quad (5)$$

With the mean blade load fixed, the actual design blade load distribution now can be established as desired, for example, according to Fig. 3:

$$q = q_m \Phi \quad (6)$$

such that the total area under the blade load curve is equal to  $q_m b$ .

Combining equations (4), (5) and (6), we find:

$$dV_u = \frac{f_m \Phi B}{b h c \gamma_z} dz = \frac{f_m \Phi B}{f_b} dz$$

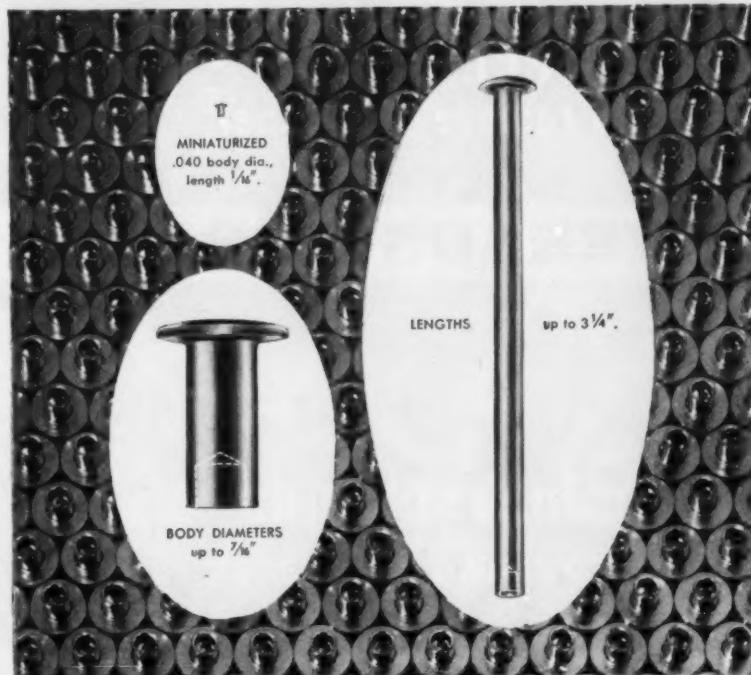
The tangential velocity  $V_u$  at any point along the blade chord is obtained by integration:

$$V_u = \frac{f_m B}{b} \int_0^z \frac{\Phi}{f} dz + V_{u0} \quad (7)$$

The initial velocity component  $V_{u0}$  is given in the velocity diagrams Figs. 4 and 5 for nozzle diaphragm and rotor as  $+A_N$  and  $-A_R$ , respectively.

(Continued on next page)

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### Blade Design . . . Cont.

The displacement of the flow particles in tangential direction within a time element  $dt$  is:  

$$dy = Vudt = Vu \frac{dz}{V_s} \quad \text{where } V_s = \frac{f}{\partial ch}$$
 and  $y = h \int_0^z \frac{Vuyc}{f} dz \quad (8)$

Equations (7) and (8) can be integrated with sufficient accuracy in finite steps if the blade chord  $b$  is divided into at least 10 equal increments. Values for the variable  $c$  are obtained from Fig. 7; values for  $\gamma$  are established by assuming a linear drop in density from blade inlet to blade exit if the corresponding pressure changes are small. If the pressure drop from blade inlet to blade exit is large, then it is safer to assume a linear temperature drop and calculate the corresponding pressure and density decrease by evaluating equation (3).

Integration of equation (8) produces the concave side of the blade in accordance with the corresponding velocity diagram at any particular radius station. The final blade profile can now be completed by adding the blade thicknesses  $d$  as well as leading edge radius and trailing edge radius as assumed in Fig. 7. If the integration of equations (7) and (8) is carried out with sufficient accuracy, then the tangents of the concave side of the blade at blade inlet and blade exit will agree with the corresponding angles of the velocity diagrams Fig. 4 or Fig. 5 within a fraction of one degree. Also, the value of  $V_u$ , integrated over the whole blade chord, must check with the vector  $B_N$  (Fig. 4) or  $B_R$  (Fig. 5).

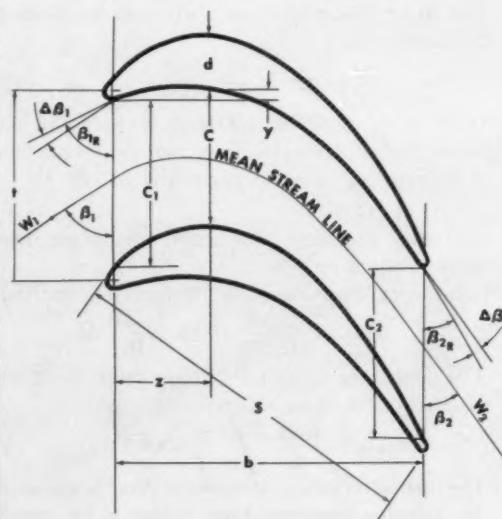
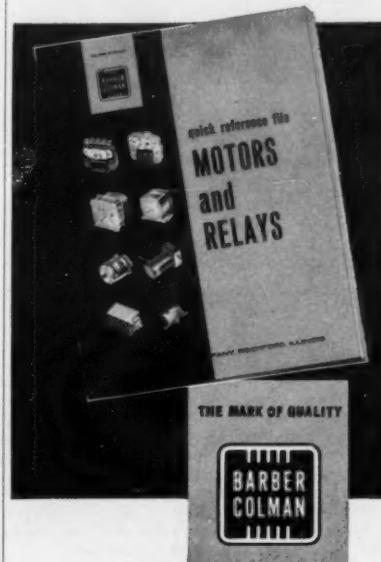


Fig. 7

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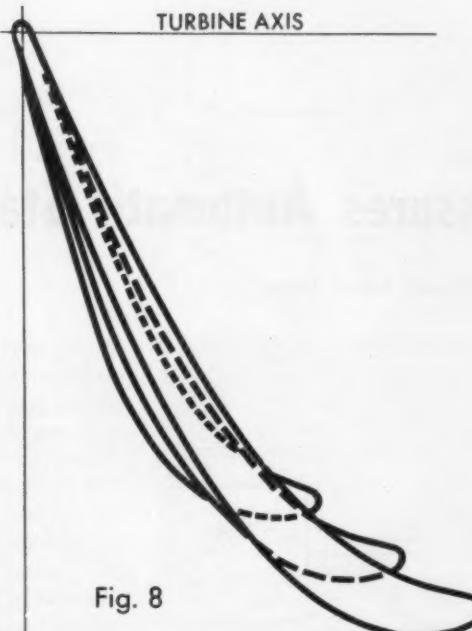


Fig. 8

To obtain a well-defined blade, at least three sections per inch of radial height should be calculated.

After the general blade shape has been completed, a final stress check is made. If some minor changes in blade thickness are required to satisfy stress requirements, the changes should be made on the convex side of the blade.

A close initial approximation of the final blade shape is essential for successful application of the design method. It was found that even a relatively inexperienced designer was able to obtain a satisfactory blade according to this method after not more than three attempts. An experienced designer usually obtains the best possible blading arrangement in the first attempt with only minor adjustments being required between the initially assumed and the final blade shape.

#### Application of Method to a Specific Case

The blade design method described above has been used at the authors' company for many years to design the blading of axial flow type turbines. The most recent application was the power output stage of a 400-hp two-shaft gas turbine engine.

Abstracted from an unpublished paper entitled "Presentation of a Blade Design Method for Axial Flow Turbines, Including Design and Test Results of a Typical Axial Flow Stage", intended for use within the Boeing Airplane Co.

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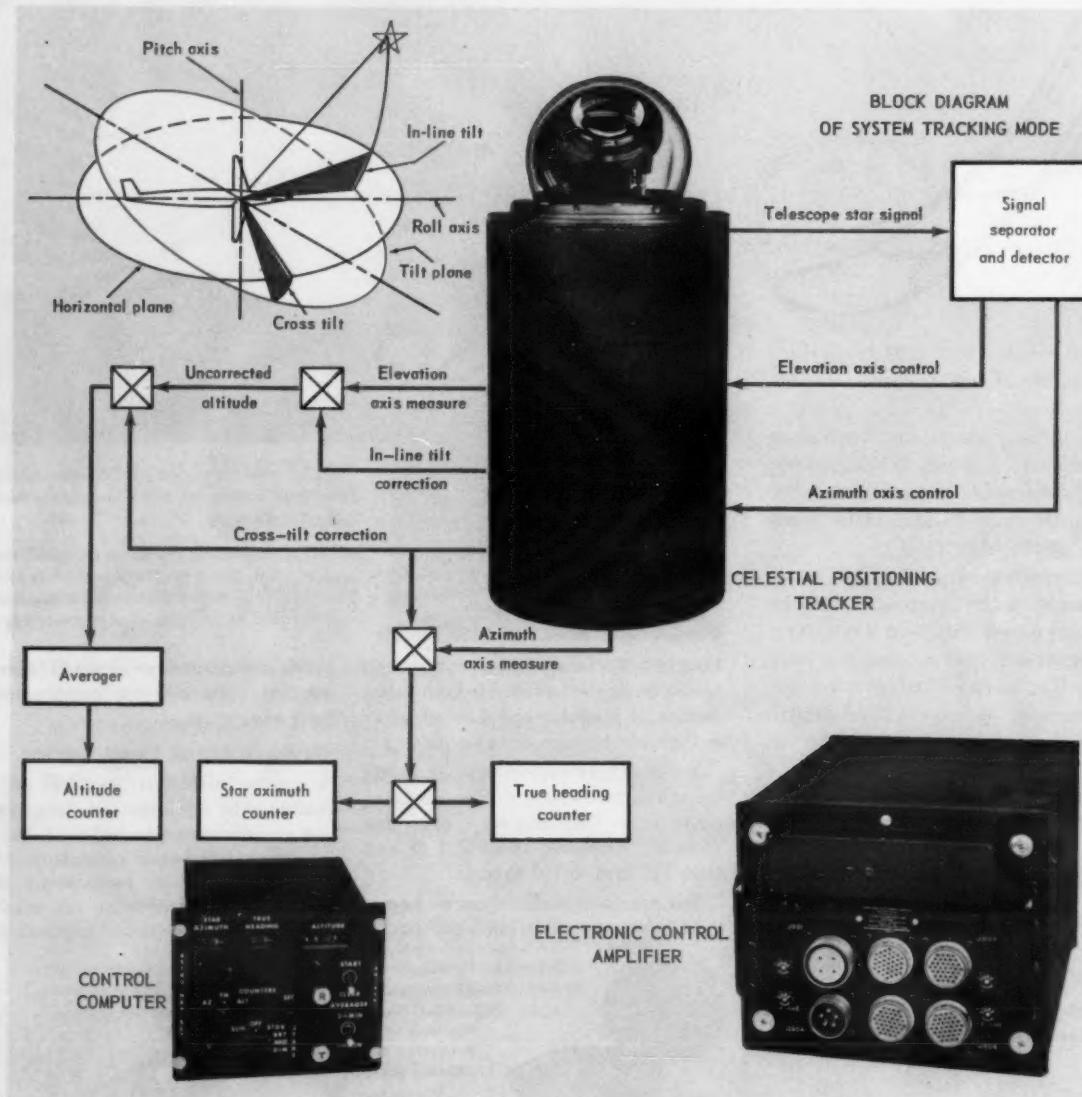
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## Sextant's Optical Wedge Assures Automatic Star Detection

Victor W. Wigotsky, Eastern Editor



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A photoelectric sextant uses a rotating optical wedge to generate an electrical signal even though the servo system is at null. This assures that background light will not prevent tracking of a star whose light intensity is obscured.

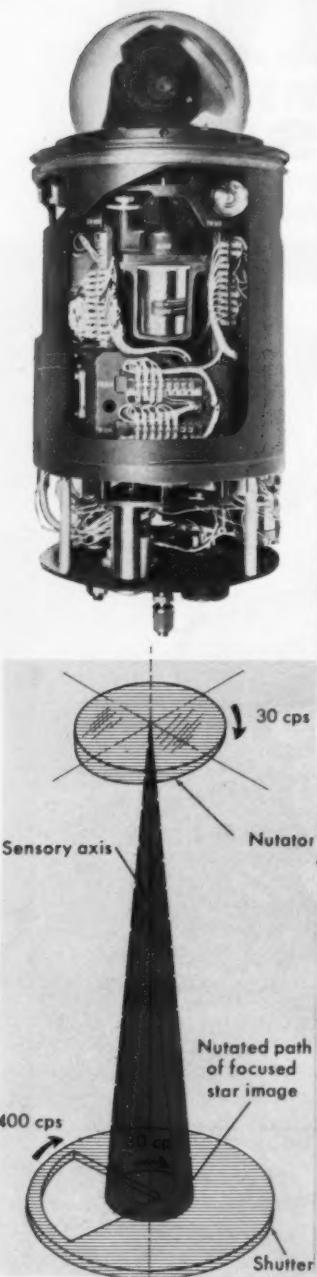
The optical wedge generates a signal when the optical axis coincides with the shutter axis. Normally, at null, a minute d-c signal is superimposed on the "noise" signal produced by background light. Automatic star acquisition then would be difficult because background light would prevent detection of this small signal.

The wedge rotates at 30 cps and deflects the line of sight a minute amount to cause the focused starlight to describe a circle in the shutter plane. The latter rotates in the same direction at 400 cps. This results in an easily detectable 370-cps signal to the system's phototube to indicate star acquisition. No error is introduced into the elevation or relative bearing axis since the "nutation" is too fast for the tracker to follow.

The sextant also features a simplified horizontal reference system. Normally, a vertical gyro is used to determine the horizontal reference plane from which all elevation angles are measured. Instead, electrolytic levels establish the required vertical without a more complex gyro. Horizontal accelerations affecting the levels are eliminated by electromechanical averaging of the system's outputs.

Back-off cams also are used to simplify the assembly while providing zero to  $360^{\circ}$  azimuth freedom. If this is obtained by use of slip-rings or differential gearing between elevation and relative bearing sections, reliability and accuracy could be impaired. The use of back-off cams permits the electrical wiring to wind up one and one-half revolutions in either direction before backing off one revolution. This insures that the wiring does not wind around itself and also permits the electrical components of the elevation and detection sections to remain close to the measuring optics of the telescope.

The KS-85 photoelectric sextant was designed by Kollsman Instrument Corp., Elmhurst, N. Y.

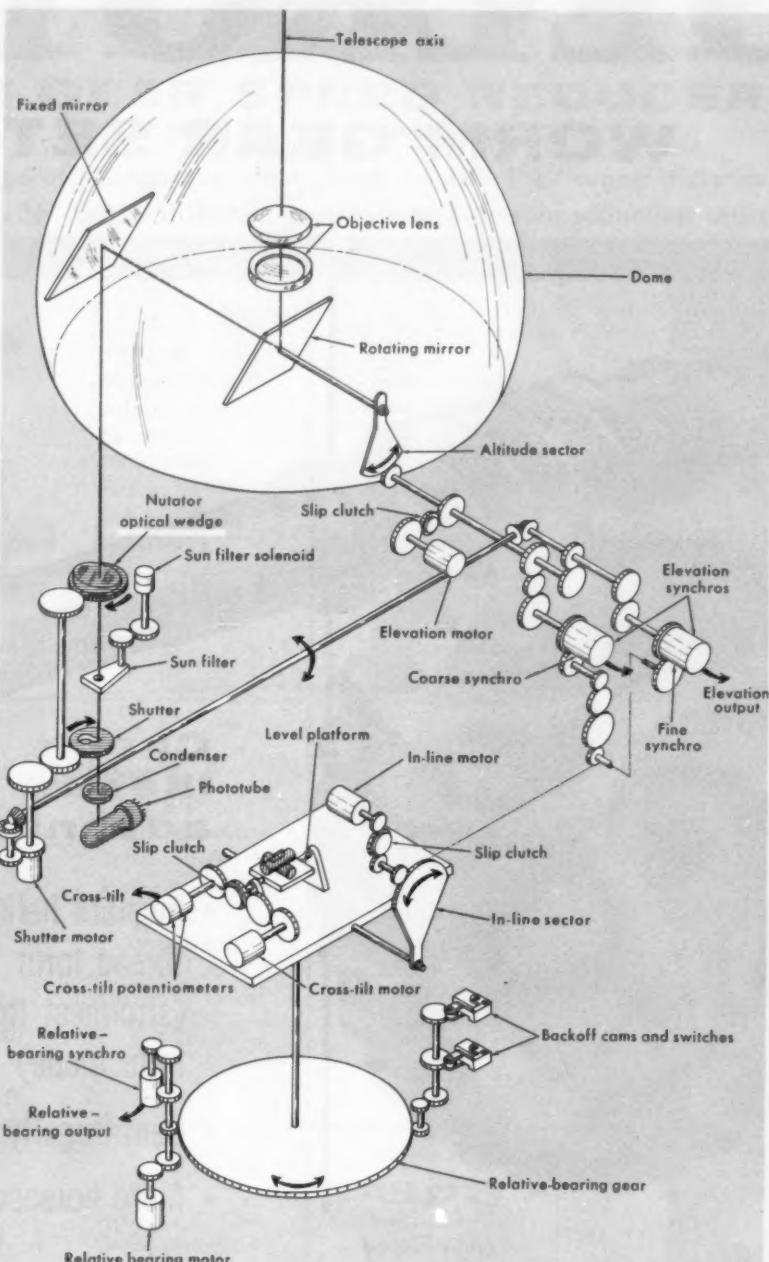


**PRECOMPUTATION OF STAR ALTITUDE** and relative bearing initially point tracking telescope in vicinity of celestial body. Search pattern scans this area and upon sighting a star, automatically senses its presence and aligns tracking telescope axis. Variations of aircraft from straight and normal flight are compensated by electrolytic levels which data-stabilize altitude and relative bearing by referencing them to horizontal plane. In event of difference in telescope optics from line of sight of star, an error signal is generated. This is used to cause telescope altitude and relative bearing axis to again coincide with star's line of sight. Automatic star acquisition is achieved by detection system which includes an optical hinge functioning with a nutator consisting of an optical wedge. Rotation of wedge in relation to shutter produces an identifiable signal to phototube in spite of presence

of background light which obscures starlight. Rotating solenoid removes sun filter from line of sight when star tracking. Optical hinge reduces size of dome, permits one-to-one relationship of celestial altitude to sector altitude and long focal length system. Hinge includes stationary and rotating mirrors which adjust line-of-sight so that it is always down center of detecting system. Connection between elevation axis and shutter motor housing compensates for error signal phase shift caused by optical hinge, which rotates image as telescope is raised from zero to 90 deg. Elevation drive rotates stator of shutter motor, thus phase-shifting error signal to discriminate between altitude and relative bearing error. Compensation in relative bearing is not required because shutter motor is mounted on azimuth axis.

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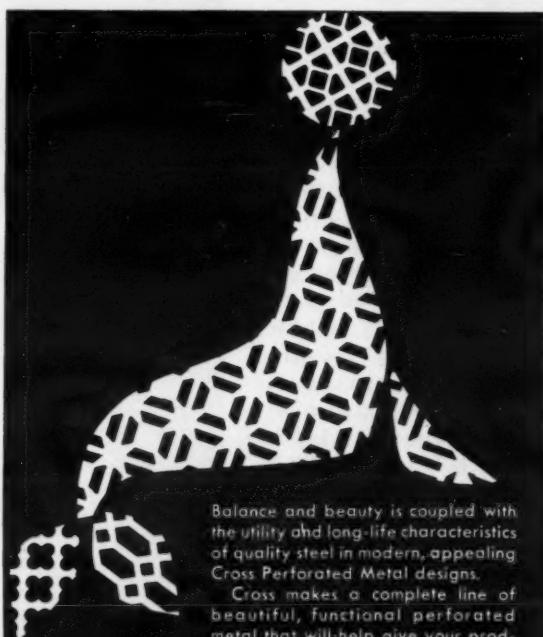
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VOLKSWAGEN OWNERS will be interested in two newly published books by Floyd Clymer, 1268 S. Alvarado St., Los Angeles 6, Calif. HOW TO DRIVE A VOLKSWAGEN gives the VW owner and the prospective owner a better understanding of the art of driving a VW, and some tips on its care and maintenance, as well as interesting comments regarding many VW features and other general information that would be of value. Photographs add interest to the 240 pages. VOLKSWAGEN COMPLETE OWNER'S HANDBOOK, Edition 2, will give the owner a better understanding of the features of this unique car. The 176 pages will answer many questions for the enthusiast and enable the owner to become better acquainted with VW design and features. Price of books: \$3.00 each.

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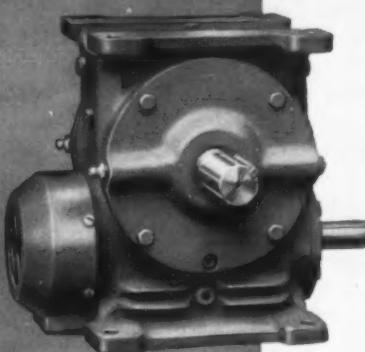
# DELROYD

## WORM GEAR SPEED REDUCERS

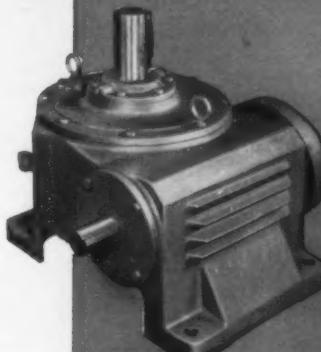
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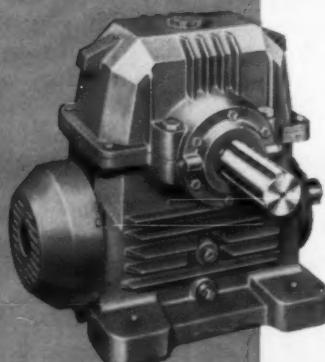
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Horsepowers:  
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Center distance:  
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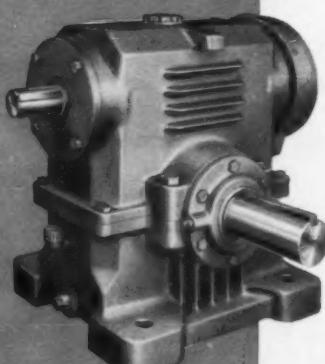
**TYPE V**  
Vertical single  
reduction  
Shaft up or down  
Ratios:  
5:1 to 70:1  
Horsepowers:  
.062 to 150  
Center distance:  
5" to 12"



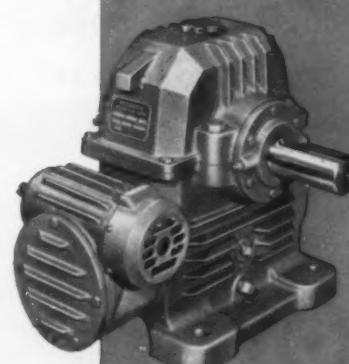
**TYPE B**  
Horizontal  
single reduction  
Bottom drive  
Ratios:  
5:1 to 70:1  
Horsepowers:  
.062 to 150  
Center distance:  
5" to 12"



**TYPE HB**  
Horizontal  
helical-worm  
Right angle drive  
Ratios:  
15:1 to 355:1  
Output torque:  
2460 in. lbs. to  
135000 in. lbs.  
Center distance:  
3½" to 12"



**TYPE T**  
Horizontal  
single reduction  
Top drive  
Ratios:  
5:1 to 70:1  
Horsepowers:  
.062 to 150  
Center distance:  
5" to 12"



**TYPE DB**  
Horizontal  
double-worm  
Parallel input  
and output shafts  
Ratios:  
75:1 to 4900:1  
Output torque:  
4170 in. lbs. to  
135000 in. lbs.  
Center distance:  
3½" to 12"

Write for Bulletin 3810

**DE LAVAL - HOLROYD INC.**

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CLASSICAL ELECTRICITY AND MAGNETISM bridges a gap between elementary accounting as taught in schools and a mathematical treatment based on Maxwell's equations. The author, E. S. Shire, combines an experimental with an historical approach, presenting the material in an interesting manner. Work of the pioneers is used to lay the foundations of a logical account, and then modern experiments and methods are considered. Tiresome and difficult mathematical parts, and material which may be omitted at first reading, are inserted in small print. Simple vector methods are used. Cambridge University Press, 32 E. 57th St., New York 22, N. Y.; 396 pages; \$7.50.

**PRINCIPLES OF ENGINEERING ECONOMY.** Eugene L. Grant and W. Grant Ireson combine their authoritative knowledge and writing talents to present an educational and understandable book about a particular type of decision making. It explains principles and techniques needed for making decisions about the acquisition and retirement of capital goods by industry and government. The material covered in this publication will serve as a college textbook, appropriate not only for engineering students, but also for students of economics, accounting, finance and management. Most important and of great value, the material contained in this 574 page manual, serves as working knowledge for engineers and management. The Ronald Press Co., 15 E. 26th St., New York 10, N. Y.; \$8.00.



Circle 192 for  
Bulletin No. 3810

DL429



## TIME-DELAY?

Heinemann can give you any set delay from a quarter-second wink to a two-minute yawn, all wrapped up in a relay no bigger than a healthy ice cube. Called the Type A Silic-O-Netic Relay, this three-ounce time-delay unit offers S.P.D.T. or D.P.D.T. switching, with up to three amps' contact capacity. All of which is pretty good, but the real clincher is the continuous-duty coil. It permits the relay to be energized continuously, to serve as a load relay, too. This eliminates the need for auxiliary lock-in circuits. Result: substantial savings in space, wire, solder—and dollars. Bulletin 5003 gives detailed specifications; a copy is yours, of course, for the asking.

## HEINEMANN ELECTRIC COMPANY

105 PLUM STREET



TRENTON 2, NEW JERSEY

2175

Circle 158 on Reader-Service Card for more information

## SCANNING PRESS RELEASES

• **COMMUNICATIONS SATELLITE** that could be used to span the Atlantic Ocean with hundreds of telephone circuits and direct television transmission has been built by Hughes Aircraft Co. The satellite will make it possible for the U. S. to place a stationary communications relay station in space during 1961.

The orbiter, shaped like a cake, is 29 inches in dia and weighs only 32 lb. The current version is designed for launching by a Scout rocket. It is intended for a stationary orbit 22,000 miles above the equator where, to an observer, it would appear "fixed" in the sky—that is, its speed would be synchronized with the earth's rotation.

A number of such space relay stations in orbit would provide immediate telephone and television communications between any points on the earth. Power for the communications repeater is provided by 2700 solar cells. Because of reduced weight, the satellite can be placed in orbit by smaller, relatively inexpensive rockets instead of large ballistic missile boosters.

Antenna directivity is achieved through the use of a pancake beam, which permits use of a spin-stabilized configuration with the spin axis parallel to the earth's axis. The use of spin stabilization affords a substantial simplification of the vernier orbital control system. A single pulsed gas jet whose thrust axis passes through the center of gravity and is normal to the spin axis is used for all orbital velocity adjustments. A second jet, whose thrust is parallel to the spin axis, provides for velocity adjustment perpendicular to the orbital plane when used in a sustained mode and for proper orientation of the spin axis when pulsed. The use of these techniques, and an integrated electronic design in which the communication repeater also serves

as a guidance signal repeater, a command receiver and a telemetering transmitter has resulted in a payload weight of only 32 lb.

The electronic package has a total weight of less than five lb, including the system's traveling wave tube. The repeater consists of a transistorized UHF receiver and L-band (2 kmc) transmitter having a power output of 2.5w. The use of single-sideband on the earth-to-payload link enables the superposition of signals from a large number of ground terminals on a frequency sharing basis, while minimizing the bandwidth requirement. A unique IF type of phase modulator converts the modulation to phase modulation for economy in power.



• **ALKALI PHOSPHATE LUBRICANTS** are reported to be effective for hot-metal forming. Certain phosphate systems provide a tenacious boundary lubricant which retains its lubricity at extreme temperatures and high pressures. These lubricants were developed by the metallurgical department of Phoenix-Rheinrohr AG in West Germany and are recommended for use at temperatures from 1100 to 2200F.

Scientists of Phoenix-Rheinrohr report increased tool life and reduced tool removal pressures in the piercing of seamless tubing by application of the new lubricant. Mandrel life was increased from 5 to 50 billets and the pressure required to remove the mandrel from the formed billet was reduced from nearly 3000 psi to from 200 to 900 psi. Similar results are reported to have been obtained in other hot-forming operations.

The basic system,  $KaNaP_2O_5$ , provides water-soluble melt which softens at high temperature. As temperature rises, the viscosity of the melt drops evenly and steadily. Solidified liquids do not crystallize after cooling. Any excess of the cooled lubricant is soluble in water except for actual phosphate layers which are removed easily in ordinary pickling baths. One of these alkali phosphate lubricants has been introduced in the U. S. by the Alpha-Molykote Corp., Stamford, Conn.

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## RELEASES...

• **IGNITRONS** will be used in test modulators for the proposed 45 billion, electron-volt linear accelerator at Stanford University. Developed by General Electric's Power Tube Dept., they will serve as switches for the two modulators to be built by Ling-Temco Electronics, Inc.

Although ignitrons have been used for many years in long-duration pulse modulator switching, this is the first time the tubes will be required to operate at high repetition rates. The ignitron was chosen as a switching device because of its ability to hold off high voltage and pass large currents.

Individual tubes will handle peak anode current of more than 3000 amps at a peak forward voltage of 56 kv, with a repetition rate of 365 pulses per second and a pulse duration of 3.2 microseconds. It is contemplated that, when complete, the two-mile-long underground accelerator will use 960 modulators, each supplying pulsed power of 75 megawatts to a klystron.

The klystrons and their accompanying modulators, placed in a tunnel along the full length of the accelerator, will provide microwave energy in the rapid and synchronized bursts needed to accelerate particles to a velocity just short of the speed of light.

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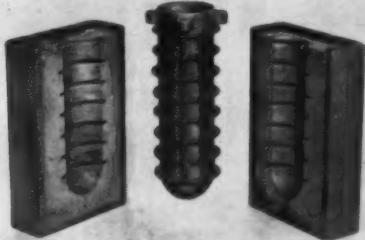
Amphenol-Borg Electronics Corporation



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DESIGN NEWS—JANUARY 16, 1961

- **SECONDARY FUEL CELL** is a self-contained, sealed device about the size of a one-lb coffee can. When used as a secondary power source, the cell can be made as small as an aspirin tablet.

The new chemical source of electricity uses a combination of sodium, bromine and mercury to produce open circuit voltages of 2.8v per cell. Peak current densities of up to 10,000 amps per sq ft for 1/10 millisecond period can be obtained. The fuel cell remains undamaged under extended short circuit conditions and will have an estimated lifetime in excess of 10,000 charge-discharge cycles.

Like other fuel cells, the secondary cell depends on the ionization of fuel to develop electrical energy. In this process, electrons are separated from the sodium, forming a positive sodium ion, and electrons are attached to the bromine, forming a negative bromine ion. Mer-



cury in the cell acts as a storage fluid for the highly reactive and exotic sodium fuel and permits safe handling of the chemical at room temperature. The mercury also acts as the negative conductor for the cell, while a carbon rod functions as the positive electrical conducting fixture.

The laboratory demonstration model is designed so that, if a short-circuit drains it completely, a charge of electricity will bring it back to life no matter how severe the short-circuit. The closed system prevents component dissipation, but should the reactants become exhausted in some other manner, the cell will still be operative after the fuel has been replenished. The cell requires no oxygen or cooling air to maintain its operating efficiency and has a shelf life that is virtually infinite.

The Smatko fuel cell, subject of pending patent application, was developed by Dr. Joseph S. Smatko, senior scientist at the Santa Barbara research facility of Hoffman Electronics Corp.

## LOOK TO THE MAN BEHIND THE MANUAL

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HIS JOB STARTS where our 150-page manual stops. He's an Instrument Ball Bearing Engineer. He's a good man to talk with before your designs are frozen. Maybe he can save you time and money. It costs nothing to find out.

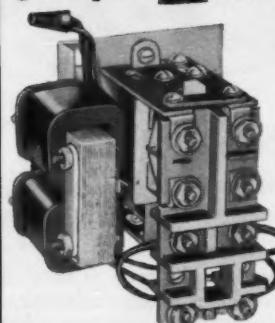
HE'S ALSO THE MAN to contact if you don't already own our manual, the nearest thing to a textbook on miniature and instrument ball bearings ever published.

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GRIPS TO YOUR NEEDS!

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The versatile Huckbolt fastener can show you worthwhile savings over most other fastening methods.

These modern, efficient fasteners are available in diameters, grips, headstyles and metals to meet your requirements.

Lightweight, easy-operating Huck power or hand tools can install these fasteners with absolute uniformity up to 30 per minute in the hands of one unskilled operator.

Your Huck fastening engineer will gladly help you.

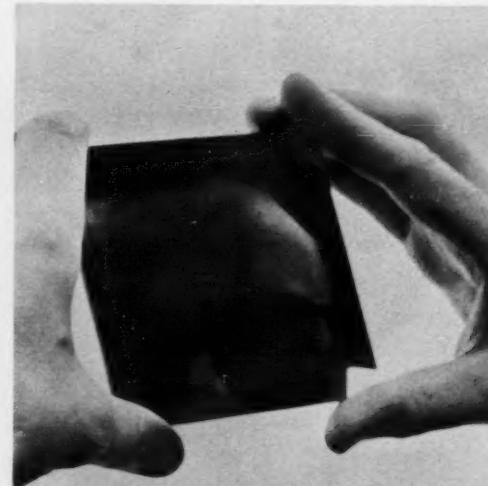
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#### RELEASES...

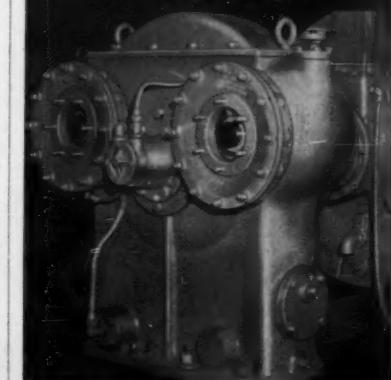
• **SPECIALLY PROCESSED SILICONE COATING** for solar cells increases their absorption of energy-producing light and decreases intake of heat and undesirable space radiation that impairs the efficiency of cells. The technique was developed by scientists of Hoffman Electronics Corp. to replace the multicoated glass covers presently being used on solar cells. It can reduce the cost of assembling the cells to the satellite structure and represents an advance toward reducing the weight of the components without sacrificing any of the deterioration-preventive characteristics of the current covers.



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--------------------	--------------------

<b>SERIES 4000</b>	<b>SERIES 4030</b>		
<b>Capacity:</b>	Up to 50 HP	<b>Capacity:</b>	Up to 200 HP
<b>Gearing:</b>	Helical, single stage	<b>Gearing:</b>	Double helical, single stage
<b>Output speed:</b>	Up to 30,000 RPM	<b>Output speed:</b>	Up to 12,000 RPM
<b>Ratios:</b>	1:1.03 to 1:5.50	<b>Ratios:</b>	1:2.00 to 1:6.58
<b>Output drive:</b>	Single	<b>Output drive:</b>	Single or dual

All units may be supplied with stub shaft or aviation accessory drives as standard equipment.

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**Versatile Put-On Tool  
Proves Money Saver  
in Design and Electronics**

With the advent of the SELECTRON Process, selective plating, a technique formerly limited to the hobby shop, has now come of age.

SELECTRON is now being used in field repairs, in R & D, and in light manufacturing. Typical applications include gold or rhodium plating of printed circuits, silver plating of bus bar and electrical contacts, repair of flanges on wave guides, precision fitting of bearings for electromechanical devices, and improvement of solderability of stainless steel, aluminum and semi-conductors. Automated SELECTRON installations are finding use in production plating on isolated areas of trans-



sistor tabs and for gold plating of capacitor leads. One ever-expanding use for SELECTRON is for prototype work. SELECTRON units—occupying only the area of a desk top—are currently electro-depositing almost any platable metal or alloy, from antimony to zinc, upon any conductive basis material. An information-packed 8-page booklet on its many advantages is available on request from SELECTRONS, Ltd., 520 Fifth Ave., New York 36, N. Y.

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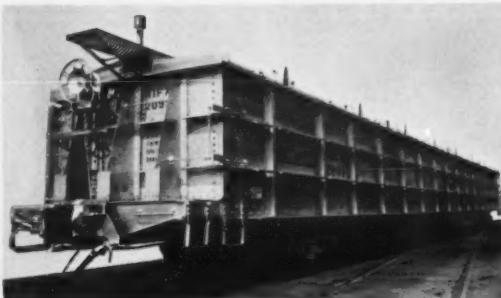
aluminum scroll			plastic scroll		
rotor size	motor type	cfm free air	rotor size	motor type	cfm free air
1½"	MC a.c.	20	1"	SC a.c.	9
1½"	MM d.c.	20	1"	SS d.c.	5
2"	FC a.c.	50	1½"	MC a.c.	17.5
2"	LL d.c.	36	1½"	MM d.c.	13
Also available in wound field designs, custom built for free air deliveries up to several hundred cubic feet per minute.					
2"	FC a.c.	20	2"	LL d.c.	25
2½"	FC a.c.	28	2½"	LL d.c.	36



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INDUSTRIES,  
INC.**

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DESIGN NEWS—JANUARY 16, 1961



• **EXPERIMENTAL RAILROAD CAR**, 85 ft long overall, has an all-aluminum body built from six extrusions, 82 ft long by 25 inches wide. Three of these channel sections are stacked longitudinally, and mechanically joined to form each side. For the roof, panel-type aluminum extrusions were fabricated into four 20-ft sections, easily removable for freight handling.

"Light weight" of the completed car is 75,900 lb. The weight of the aluminum superstructure is under 10,000 lb. A comparable conversion into steel would have added an eight-ton burden. Load limit is 134,100 lb; capacity is 3240 cu ft.

The experimental unit was developed by Harvey Aluminum in cooperation with the Rock Island Lines and North American Car Corp.

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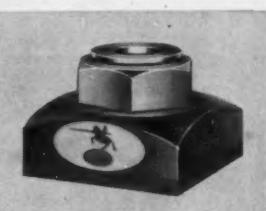
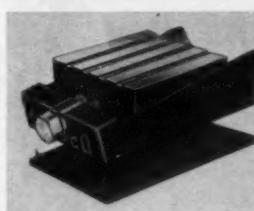
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**HE'LL SEND YOU** our manual if you already don't own it. It belongs in the files of every qualified engineer, draftsman or purchasing agent.

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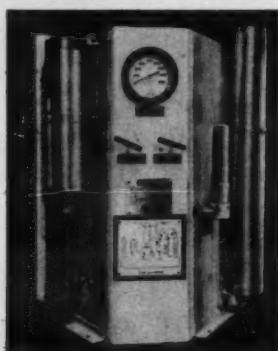
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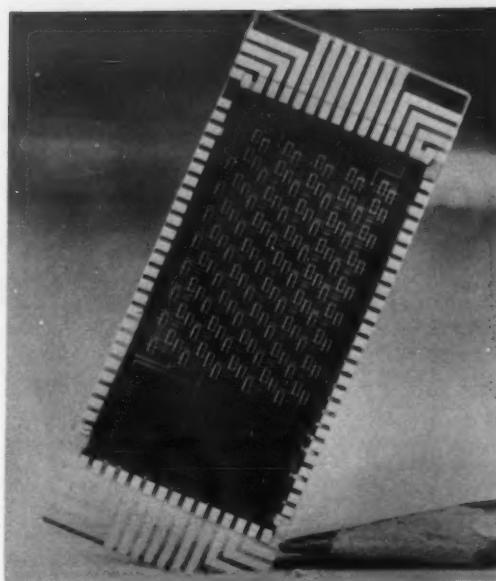
## RELEASES...

• CRYOGENIC, THIN-FILM MEMORY PLANE, the size of a postage stamp, has been fabricated successfully by the International Business Machines Corp. IBM has also developed automatic control techniques capable of duplicating the memory plane. The plane consists of 135-cryotron devices built up in 19 layers of material.

Three cryotrons form a memory cell which combines storage with an elementary logic operation. Because of this combination of functions, sophisticated operations not practical before may be realized.

Forty separate pieces or "bits" of information are stored in 120 cryotrons. Of the remaining 15 cryotrons, 10 permit access to the stored bits of information; the other five are "in-line" cryotrons which switch bits of information from one memory plane to another. These newer "in-line" cryotrons operate faster than conventional cryotrons in communicating between the memory planes. They also permit faster communication between the memory planes and the arithmetic portion of the computer.

The equipment used for deposition allows each layer of a metal or insulator to be deposited sequentially through 17 microscopically adjusted



masks, or perforated metal sheets. The masks are changed automatically like records in a juke box and are held in a large metal cylinder operating under high vacuum. Once the masks have been aligned properly, the process automatically produces duplicate superconducting memory planes with similar electrical and mechanical characteristics.

## Looking Towards Tomorrow... To Serve You Better Today



Castings produced by shell molding, CO<sub>2</sub>, and regular sand molding processes, are available from Wells in production quantities up to approximately 60 pounds in weight.

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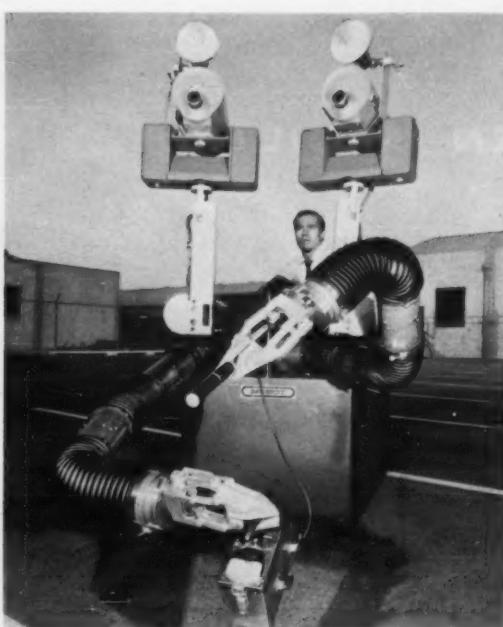
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• **MOBILE ROBOT**, called "Mobot", is a complete, electromechanical manipulating system that, on command, can carry out many handling jobs by remote control. It is designed for environments that are beyond man's capacity and for tasks beyond man's capabilities.

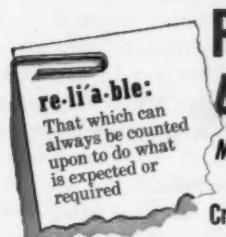
The Mobot consists of six separate modules: a handling arm, power unit, control console, vehicle, multiplex command system and television viewing system. The modules can be combined into various packages depending upon application, space or environment.

Television cameras are mounted on remote-controlled booms for flexibility in viewing. The data and command link is a single tri-axial cable carrying more than 100 command channels, two video channels and 60-cycle a-c power from the console to the vehicle.

The Mobot arm will move 180 deg in any direction at each of three joints; it is 6 ft long and can lift 25 lb with the arm unit in any position. The wrist will rotate continuously in either direction. The hand telescopes 3½ inches. The unit can be mounted on a wall, pole, boom or on a remote-controlled vehicle.

The vehicle module is three-wheeled and is steered by a single rear wheel. It is 29 inches wide and 43 inches high. Motion of the vehicle and all movements of the arm are controlled by lever-type toggle switches located at the operator's console.

Mobot's operator, located at the console safely outside any hazardous area, has complete control of all handling system functions. The Mobot Mark II was created at Hughes Aircraft Co., Los Angeles, Calif.



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DESIGN NEWS—JANUARY 16, 1961

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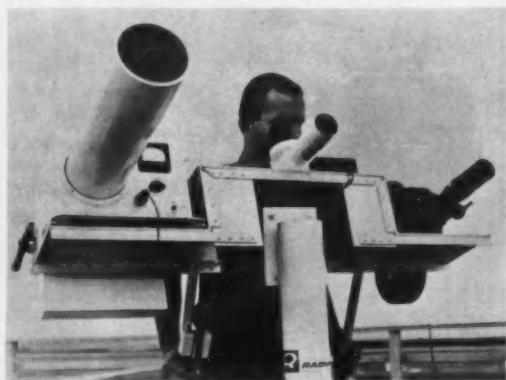
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### RELEASES...



- "MISSILE BLOOM" EFFECT, occurring shortly after launch of a ballistic missile, is being studied by The Research Div. of Radiation Inc. Purpose of the study is to obtain spectral and configurational information on the phenomenon.

The missile bloom effect occurs in conjunction with most nocturnal ballistic missile launchings at an altitude of about 120 kilometers. It appears as a whitish glow surrounding the missile, has a rapid growth that persists for many seconds and has a diameter of several miles.

Specialized radiation-measuring equipment consists of a 35mm cine camera with an eight-inch focal length, f/3.5 lens to obtain the configuration data. Spectral information is obtained by a radiation spectral-visual photometer. The photometer utilizes a five-inch aperture, 24-inch focal length lens and a photomultiplier tube detector. Information is provided by means of a series of interference filters which are mounted on a wheel and rotate in front of the photomultiplier detector. A total of 13 interference filters is used, providing spectral information from 0.385 to 0.572 micron, with an average bandwidth of 0.01 micron.

The signal from the photomultiplier tube is amplified and recorded and the whole system is calibrated in radiometric units. Range timing is supplied to both the camera and the photometer for correlation purposes. Photometer and camera are mounted on a tracking head and pedestal-type mount.

Spectral and configuration data are correlated to give an indication of the quality of track and the relation between the spectra and the shape of the bloom. In addition, these data are correlated with missile-type, ionosphere back-scatter signals and ambient meteorological conditions to give an understanding of the mechanisms and energies involved in the production of missile bloom.

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DESIGN NEWS—JANUARY 16, 1961

- SLIDE RULE visualizes and determines the physical relationship between a satellite moving around the earth and the earth rotating about its axis. Developed for the Air Force's Rome Air Development Center and called the Satellite Trajectory Simulator, the computing device pinpoints the path of a satellite by translating its "variables of motion" (such as time and place of launching, angle of inclination and altitude) into a series of time-recorded paths across a map of the earth.

The information permits computation to determine those geographical areas visible from the satellite as well as the frequency and times it will pass over any particular predetermined point on the ground. The Simulator also may be worked backwards to determine the launch conditions (time and place) necessary to achieve a satellite's journey. In addition to the satellite's physical relationship with earth, other conditions involving flight and weather may be determined and coordinated.



SIMULATOR consists of square metallic base and two upper discs consisting of orbit disc that depicts any one of several satellite paths, and map disc which is polar stereographic projection of northern hemisphere. Made of transparent plastic, these replaceable concentric discs are fixed to base at center, with free independent rotation about center. Various scales and reference lines are provided to determine such factors as time of passage over particular locations, and darkness or daylight conditions for any point at any time.

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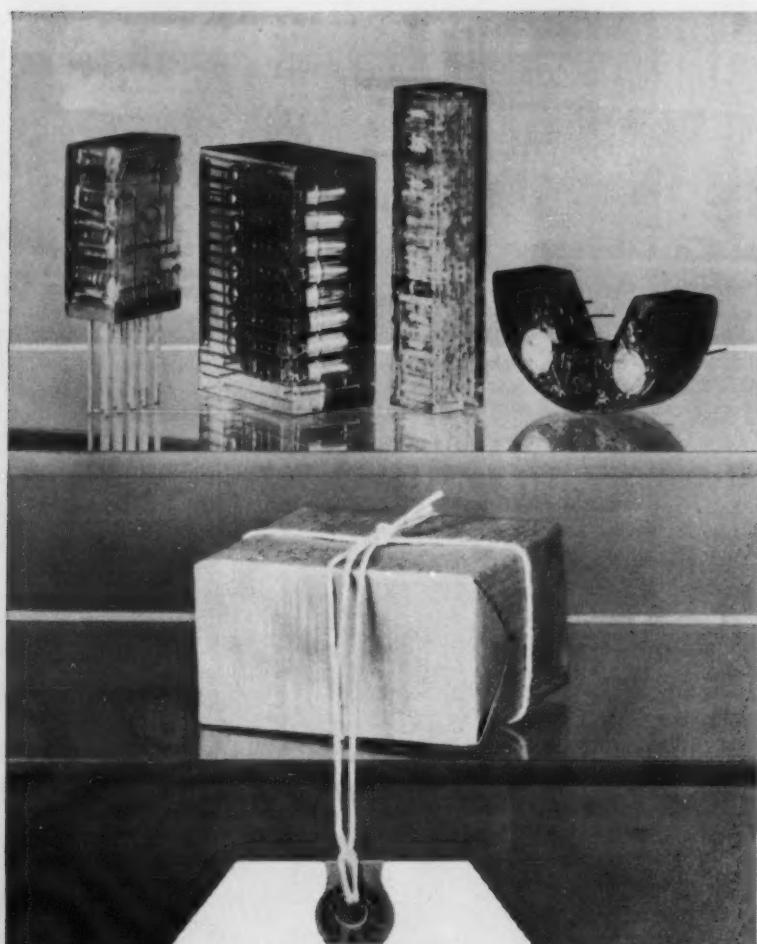
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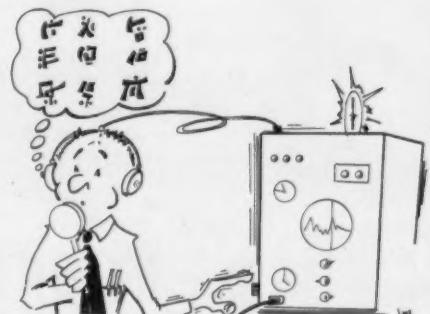
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### **PLANS AND CROSS-SECTIONS**

#### **Right or Left Eared?**

Dr. Alfred Tomatis, an ear, nose and throat specialist with a research department in France, says that a person may be left-eared or right-eared, just as he may be left-handed or right-handed. He says the voice-monitoring circuit in the brain passes through both sides of the brain and produces a time lag varying from  $1/5$  to  $1/40$  of a second. When the time lag is between  $1/10$  and  $1/40$  of a second, the patient stammers in his speech. The fault usually can be cured by exercising the "directive" ear.

To do this, the research department of the French Ministry of Education is testing a machine said to be an aid in curing stuttering and to make the learning of foreign languages easier. The machine consists of a pair of earphones and a microphone with circuitry that can turn an American accent into an Oxford drawl, or a guttural German into snappy Paris-

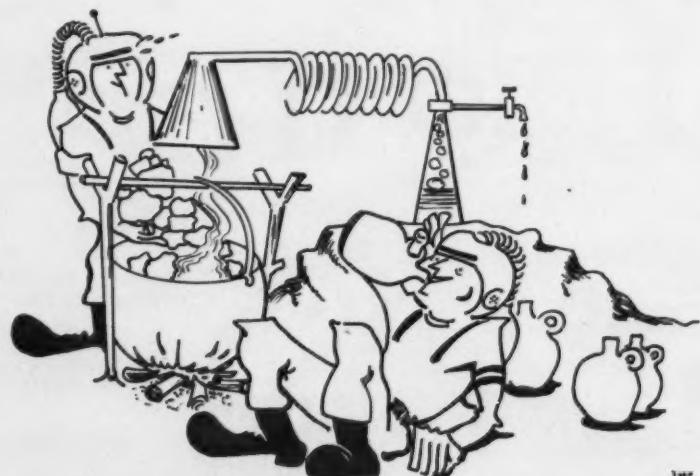


ian French at the turn of a knob. The patient speaks into a microphone and hears his voice amplified into one earphone placed over his directive ear. For language tuition, two earphones are used until the directive ear has been trained for this teaching process. Can it be that we will soon learn languages simply by listening to ourselves speak?

### **Rocks on the Rocks**

What will our future space men do when they need water on the moon? Dr. Roy G. Brereton of Aerojet-General thinks it is possible to get water from rocks. He thinks that by heating certain kinds of rocks, it should be possible to extract up to five percent of their weight in water.

His suggestion is to use solar mirrors to focus heat on the rocks, then direct the resulting steam on a dome, the condensation then used as drinking water. The results of this do-it-yourself distillery have already been appropriately dubbed Moonshine.



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## IN BRIEF

- NASA announces the following space vehicles in orbit as of Dec. 15, 1960:

Name/Country	Launch Date	Transmitting
Explorer I (US)	Jan. 31, 1958	No
Vanguard I (US)	Mar. 17, 1958	Yes
Lunik I (USSR)*	Jan. 2, 1959	No
Vanguard II (US)	Feb. 17, 1959	No
Pioneer IV (US) *	Mar. 3, 1959	No
Explorer VI (US)	Aug. 7, 1959	No
Vanguard III (US)	Sept. 18, 1959	No
Explorer VII (US)	Oct. 18, 1959	Yes
Pioneer V (US) *	Mar. 11, 1960	No
Tiros I (US)	Apr. 1, 1960	Yes
Transit I-B (US)	Apr. 13, 1960	No
Spacecraft I (USSR)	May 15, 1960	No
Midas II (US)	May 24, 1960	Yes
Transit II-A (US)	June 22, 1960	Yes
NRL Satellite (US)	June 22, 1960	Yes
Echo I (US)	Aug. 12, 1960	Yes
Courier I-B (US)	Oct. 4, 1960	Yes
Explorer VIII (US)	Nov. 3, 1960	Yes
Tiros II (US)	Nov. 23, 1960	Yes

\*In solar orbit; others in earth orbit.

• **PERMANENT U. S. TRADE CENTER**—first of its kind—where products of American private industry will be displayed and sold year-round, will open in London, England. Center will be under management of U. S. Department of Commerce in collaboration with the U. S. Department of Agriculture. The "showcase for American goods" will offer a new dimension to established and potential U. S. exporters for introducing or furthering sales of their products in U. K. and Commonwealth markets.

• **LATEST IN TARGET MISSILES** is the OQ-19E, manufactured by Northrop Corp.'s Radio-plane Div. Incorporating a six-cylinder engine and advanced passive reflectivity system, this 240-knot target drone is intended to satisfy increased performance characteristics required in training of troops on advanced surface-to-air missile systems.

• **ADMIRAL ARLEIGH BURKE**, USN, Chief of Naval Operations, heads a list of distinguished military officers and civilians who will serve as advisors for the Fifth National Convention on Military Electronics (MIL-E-CON 1961), to be held at the Shoreham Hotel, Washington, D. C., June 26, 27 and 28, 1961. This annual meeting is sponsored by the Professional Group on Military Electronics of The Institute of Radio Engineers.

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*Write For Bulletin MH-2-P*

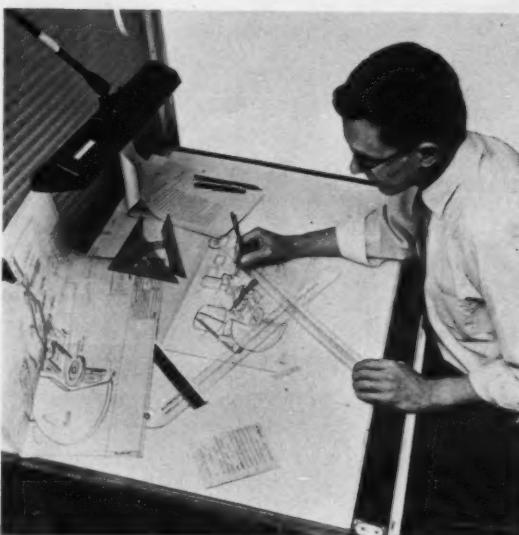


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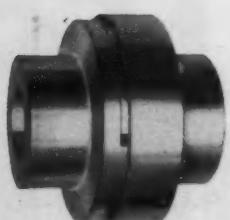
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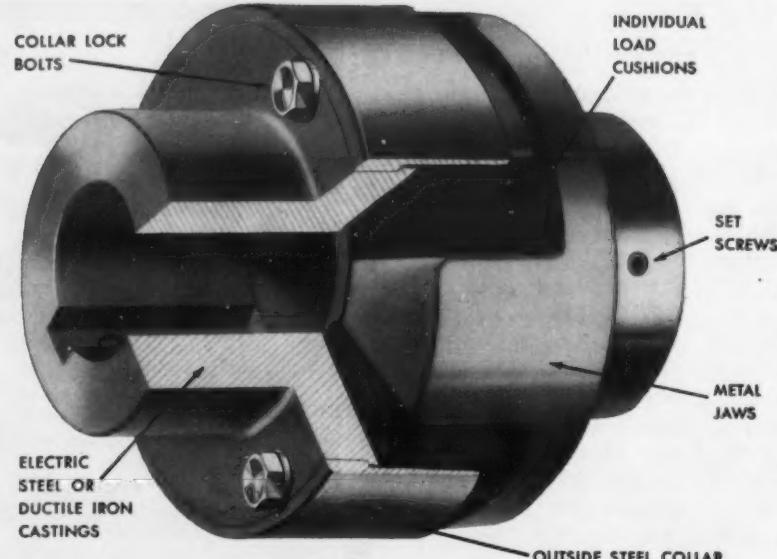
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**IN BRIEF...**

- **ENGINEERING FUNDAMENTALS** is the title of a correspondence course offered nationwide to aid engineers in preparing for professional registration. The course was developed by Lloyd M. Polentz, P. E., and was designed to be of benefit to all engineers preparing for first, or closed-book, portion of engineering registration examination in any of 50 states or three territories. Course is also aimed at engineers who wish to review fundamentals as an aid to current work or in preparation for advanced study. Information and application for enrollment may be obtained from Department of Correspondence Instruction, University Extension, University of Calif., Berkeley 4, Calif.

**Meetings**

New York, N. Y. Jan. 23-25	NATIONAL ANNUAL MEETING, Institute of The Aeronautical Sciences, Hotel Astor.
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Washington, D. C. Jan. 24-27	NATIONAL MEETING, American Mathematical Society, Willard Hotel.
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Washington, D. C. Jan. 24-27	ANNUAL TECHNICAL MEETING, Society of Plastics Engineers, Shoreham and Park Sheraton Hotels.
---------------------------------	---

Chicago, Ill. Jan. 30-Feb. 2	PLANT MAINTENANCE AND ENGINEERING SHOW, International Amphitheater.
---------------------------------	---

Chicago, Ill. Feb. 2-3	INDUSTRIAL MANAGEMENT ENGINEERING CONFERENCE, Illinois Institute of Technology.
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Lights, inspection	.....

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### BUSINESS STAFF

R. W. Rice . . Advertising Services Manager  
R. K. Kinnes . . Manager, Circulation Services  
3375 S. Bannock St., Englewood, Colo.

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